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North Carolina State University

1985-1986

UNIVERSITY DIRECTORY

EMERGENCY
3333

1985-1986

UNIVERSITY DIRECTORY

University Exchange 737-2011

Campus Operator 0
Outside Operator 9-0

Emergency Numbers

Police, Fire, Ambulance, Emergency	3333
Medical Aid—Student Health Services	2564
or call Emergency	3333
Accidents involving radioactive materials—	
Call	2894
Nights, Saturdays, Sundays or holidays	787-8637
Physical Plant (during working hours)—	
To report malfunctions and breakdowns	
Control Center	2991

STATE TELECOMMUNICATIONS NETWORK

Official business calls to any point in the continental U.S. may be economically made using this system.

Rates: 12¢ per minute, in state

30¢ per minute, out of state

Dial 8—area code—seven digit number

Conference Calls: Up to 10 parties can be included by dialing 733-1110 and giving the operator required information. **Very Important:** Advance notice must be sent to each party so they will be available.

REPAIR SERVICE

Call Southern Bell780-2711
to report line problems such as no dial tone or noise.

Call AT&T1-800-242-2121
to report troubles pertaining to telephone sets or equipment.

Be prepared to provide your telephone number and the University exchange number shown above when requesting repairs.

COVER PHOTO of President Ronald Reagan with the NCSU mascots is courtesy of "The News and Observer."

This directory is published in limited numbers by North Carolina State University for use by University personnel and is not for public distribution.

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TELEPHONE INSTRUCTIONS

LOCAL CALLS

To other campus telephones, dial the four digit number listed in this directory.

To Raleigh telephones, dial 9 plus the seven digit number listed in the Raleigh telephone directory.

To student residence halls, dial 9 plus the seven digit number.

LONG DISTANCE CALLS

Long distance calls will be charged to your telephone number.

Station to Station (Direct) Dial 8—area code—seven digit number.

Person to Person, Credit Card and/or Charge to Third Number Dial 9—0—area code (if not 919)—seven digit number. Operator will then answer and assist call.

TRANSFERRING CALLS

To transfer a call, remain on the line, depress the receiver button once for one second and release. Listen for dial tone, then dial campus number desired. Stay on line until number answers, then announce call and hang up. Any incoming call may be transferred, whether it is from another campus phone or an off-campus location.

THREE PARTY CONFERENCE

To add another party to an existing conversation, depress receiver button for one second and release, dial number desired. When the party answers, depress receiver button and release. You have a three party conversation.

CONFERRING PRIVATELY

To confer with a second party when you already have someone on the line, depress the receiver button for one second and release. Listen for dial tone, dial campus number desired. The initial party cannot hear conversation. When conferring party hangs up, you are automatically reconnected to the initial caller.

DIRECTORY CHANGES

Advise the operator (dial 0) immediately of all personnel changes affecting campus telephone numbers so that the listings can remain current.

TELEPHONE EQUIPMENT OR SERVICE CHANGES

The following procedure should be followed for ordering additions or changes in telephone service.

1. Contact the Telecommunications Office to secure technical information, if needed, prior to submitting a request.
2. Prepare a Service Unit Requisition form identifying the specific additions or changes desired. Identify the affected telephone numbers, room locations, type and color of telephone sets, and the name and telephone number of a contact person. Include your financial fund code. Submit the form to the Telecommunications Office for processing.
3. Your request will be processed with the appropriate telephone companies and your account charged on completion.



NORTH CAROLINA STATE UNIVERSITY

ADMINISTRATION

Chancellor	Bruce R. Poulton	A Holladay, Box 7001 ...	2191, 2192
Provost and Vice Chancellor	Nash N. Winstead	109 Holladay, Box 7101	2195
Vice Provost and Dean of the Graduate School	Jasper D. Memory	103 Peele, Box 7102	2394
Vice Chancellor for Develop- ment	John T. Kanipe Jr.	12 Holladay, Box 7501	2846
Vice Chancellor for Extension and Public Service	W.L. Turner	200 McKimmon, Box 7401	2144
Vice Chancellor for Finance and Business	George Worsley	B Holladay, Box 7201	2155
Vice Chancellor for Research	Franklin D. Hart	208 Daniels, Box 7003	2117
Vice Chancellor for Student Affairs	Thomas H. Stafford Jr. ..	101 Holladay, Box 7301 ..	2446, 2447
Director of University Relations	Albert B. Lanier Jr.	17 Holladay, Box 7501	2850
Executive Assistant to the Chancellor	Karen R. Peterson	A Holladay, Box 7001	3062
Secretary of the University	William H. Simpson	A Holladay, Box 7001	2200
University Counsel	Clauston L. Jenkins Jr. ..	A Holladay, Box 7001	2319

DEANS OF THE SCHOOLS

Agriculture and Life Sciences	J. E. Legates	112 Patterson, Box 7601	2668
Design	Claude E. McKinney	200-A Brooks, Box 7701 .	2201, 2202, 2208
Education	Carl J. Dolce	208-C Poe, Box 7801	2231, 2232
Engineering	Larry K. Monteith	102 Page, Box 7901	2312
Forest Resources	Eric L. Ellwood	2028-H Biltmore Box 8001	2883, 2884
Humanities and Social Sciences ...	William B. Toole III	106 Link, Box 8101	2467
Physical and Mathematical Sciences	Garrett Briggs	122 Cox, Box 8201	2501, 2502
Textiles	Dame S. Hamby	101 Nelson, Box 8301	3231
Veterinary Medicine	T. M. Curtin	4700 Hillsborough St. Box 8401	829-4210

THE UNIVERSITY OF NORTH CAROLINA

GENERAL ADMINISTRATION

Chapel Hill	
Central Telephone	919-962-6981
President	William C. Friday
Vice President—Academic Affairs	Raymond H. Dawson
Vice President, Acting—Research and Public Service Programs	Jasper D. Memory
Vice President—Finance	L. Felix Joyner
Vice President—Planning	Roy Carroll
Vice President—Student Services and Special Programs	
Secretary of the University	John P. Kennedy Jr.
Assistant to the President	Arnold K. King
(for Relations with Faculty, Assembly, Private Colleges and Universities, and the Community College System)	
Assistant to the President	Roscoe D. McMillan Jr.
(for Governmental Affairs)	
Assistant to the President	Richard H. Robinson Jr.
(for Legal Affairs)	
Assistant to the President	Trudy W. Atkins
(for Public Relations)	

NCSU BOARD OF TRUSTEES

Wallace J. Conner Newport, N.C.	Jack P. Jordan Mt. Gilead, N.C.
Alan T. Dickson Charlotte, N.C.	Elizabeth B. Lee Lumberton, N.C.
Troy A. Doby Sr. Raleigh, N.C.	Clarence Lightner Raleigh, N.C.
John N. Gregg Valley Forge, Pa.	Gerald H. Long Winston-Salem, N.C.
Daniel C. Gunter Gastonia, N.C.	Edward I. Weisiger Charlotte, N.C.
James A. Hackney III Washington, N.C.	T. Baxter Williams Jr. Currituck, N.C.
Ex officio: Student Body Pres. Jay Everette 4130 Univ. Student Ctr.	Asst. Secretary William H. Simpson A Holladay Hall—737-2200

SCHOOLS, DEPARTMENTS,
DIVISIONS AND OFFICES

A

Office	Head	Address	Phone
Academic Skills Program			
Director	Hugh Fuller	528-A Poe, Box 7105	3163
Academic Advancement	Thomas Conway	528-A Poe, Box 7105	3163
Academic Advancement For Stu. Athletics	Joe Brown	124 Reynolds Coliseum, Box 7104	2464, 3680
Academic Support Services	Brenda Allen	300-D Poe, Box 7105	3592
Univ. Undesignated	Joan Mills	528-A Poe, Box 7105	3163
Accounting, Academic Programs	C. J. Messere	201-F Patterson, Box 8109	3273
Accounting Office			
Director	Ernest G. Murphrey	7 Holladay, Box 7205	3824
Asst. Dir., General Accounting	James C. Langfahl	9 Holladay, Box 7205	3823
Supv., Accounts Payable	Deborah P. Lane	1 Holladay, Box 7204	2158
Supv., Capital Assets			
Accounting	John C. Hubbard	10 Holladay, Box 7205	2148
Supv., Fund Accounting	Lou F. Rosendahl	1 Holladay, Box 7203	2149
Supv., Spec. Accounting Serv.	Billy R. Bunn	10 Holladay, Box 7205	2148
Supv., Travel Audit	Tassie Brooks	5 Holladay, Box 7204	3152
Mgr., Payroll & Benefits	Ruth Ellis	Leazar Lower Level, Box 7215	2151
Supv., Payroll	Henry J. Beeker Jr.	Leazar Lower Level, Box 7215	2151
Supv., Benefits		Leazar Lower Level, Box 7215	2151
Administrative Computing Services			
Director	H. Leo Buckmaster	B-21 Hillsborough Bldg., Box 7209	2794
Admn. Asst.	Doratha Moore	B-21 Hillsborough Bldg., Box 7209	2794
Mgr., Fin. and Bus. Unit	Sidney Holmes	Leazar Lower Level, Box 7209	3541
Mgr., Contract Serv. Unit	Nancy Moxley	B-21 Hillsborough Bldg., Box 7209	2794
Mgr., Data Base	Ronald Melbourne	B-21 Hillsborough Bldg., Box 7209	2794
Mgr., Data Processing	Dennis Norris	11 Peele, Box 7208	2459
Mgr., Info. Ctr.	Jeffrey Hunter	14 Peele, Box 7208	3110
Mgr., Stu. Aff. Unit	Allen Brady	B-21 Hillsborough Bldg., Box 7209	2794
Mgr., Systems	John Hamlet	B-21 Hillsborough Bldg., Box 7209	2794
Admissions			
Director	Anna P. Keller	112 Peele, Box 7103	2437
Assoc. Dir.	George R. Dixon	112 Peele, Box 7103	2437
Asst. Dir.	Thomas H. Griffin	112 Peele, Box 7103	2437
Asst. Dir.	Rhonda W. Huffman	112 Peele, Box 7103	2437
Asst. Dir.	Kay P. Leager	107 Peele, Box 7103	2437
Asst. Dir.	Sotello V. Long	105 Peele, Box 7103	2437
Adult and Community College Education			
Head	E. J. Boone	117 Ricks, Box 7607	2707
Affirmative Action Officer & Compliance			
Officer for Title IX	Lawrence M. Clark	201 Holladay, Box 7101	3148
Agricultural Communications			
Head	D. M. Jenkins	118 Ricks, Box 7603	2800, 2804
Educational Media Center		2317 Library, Box 7603	3971
Press, Radio, TV		314 Ricks, Box 7603	3173
Publications		318 Ricks, Box 7603	3173
Service Section		G-5 Ricks, Box 7603	2791
Visual Communications		G-1 Ricks, Box 7603	2861

Office	Head	Address	Phone
Agricultural Economics, Economics & Business			
Agri'l. Res. & Coord. of Advising	R. K. Perrin	220-C Patterson, Box 8109	2607
Extension	M. A. Johnson	212 Patterson, Box 8109	3107
Grad. Prog. Coord.	M. B. McElroy	214 Patterson, Box 8109	2607
Agricultural Education; Occupational Education			
Coordinator	L. R. Jewell	602-M Poe, Box 7801	2234
Agricultural Institute			
Director	H. Bradford Craig	107 Patterson, Box 7601	3248
Agricultural Research Service	D. F. Bateman	100-B Patterson, Box 7601	2718
Agriculture and Life Sciences, School of			
Dean	J. E. Legates	112 Patterson, Box 7601	2668, 2641
Business Officer	R. W. Gay Jr.	120 Patterson, Box 7601	2710
Academic Affairs			
Assoc. Dean & Dir.	E. W. Glazener	115 Patterson, Box 7601	2614, 2615
Assoc. Dir.	H. Bradford Craig	107 Patterson, Box 7601	3248
Acad. Adv. & Placement	R. E. Parries	111 Patterson, Box 7601	3249
Agricultural Extension Service			
Assoc. Dean & Dir.	C. D. Black	104 Ricks, Box 7602	2811, 2812
Assoc. Dir.	R. C. Wells	106 Ricks, Box 7602	2812, 2811
Asst. Dir., Agri. & Spec. Prog.	D. G. Harwood	302 Ricks, Box 7602	3252
Asst. Dir., Comm. & Rural Dev.	J. A. Phillips	211 Ricks, Box 7602	3467
Asst. Dir., County Operations	P. E. Dew	108 Ricks, Box 7604	2813
Asst. Dir., 4-H & Youth Dev.	D. R. Proctor	201 Ricks, Box 7606	2801, 3242
Asst. Dir., Home Econ.	Martha R. Johnson	107 Ricks, Box 7605	2781
Asst. Dir., Training	E. J. Boone	117 Ricks, Box 7607	2707
Ext. Personnel Dev. Spec.		109 Ricks, Box 7602	2814
Agricultural Research Service			
Assoc. Dean & Dir.	D. F. Bateman	100-C Patterson, Box 7601	2718
Assoc. Dir., Intl. Prog.	J. L. Apple	209 Daniels, Box 7112	2665, 3201
Assoc. Dir.	George J. Kriz	100-A Patterson, Box 7601	2719
Asst. Dir.	R. E. Cook	100-D Patterson, Box 7601	2718
Asst. Dir.	E. B. Cowling	2028 Biltmore, Box 8001	2883, 3284
Asst. Dir.	W. H. Johnson	100-B Patterson, Box 7601	2717
Asst. Dir.	C. E. Stevens	4700 Hillsborough St., Box 8401	829-4312
Agromeck			
Editor	Roger Winstead	3123 Univ. Stu. Ctr., Box 8606	2409
Air Force ROTC	Col. Cleveland Simpson	145 Reynolds Coliseum, Box 7308	2417
Alumni Relations			
Director	Bryce R. Younts	Alumni Bldg., Box 7503	3375
Assoc. Dir.		Alumni Bldg., Box 7503	3375
Asst. Dir.	B. Bryant Allen	Alumni Bldg., Box 7503	3375
Editor	Jeri Gray	Alumni Bldg., Box 7503	3375
Animal Science			
Head	C. A. Lassiter	123 Polk, Box 7621	2755, 2756
Accounting	Becky Stephenson	122 Polk, Box 7621	3532
Animal-Forage Metabolism Complex		Trenton Rd.	851-1803
Dairy Records Proc. Ctr.		Leazar, Box 7623	2632
Ext. Animal Husbandry	R. G. Crickenberger	117 Polk, Box 7621	2761
Ext. Dairy Husbandry	F. N. Knott	102 Polk, Box 7621	2771
Ext. Swine Husbandry	J. R. Jones	201 Polk, Box 7621	2566
Grinnells Animal Health Lab		Western Blvd., Box 7626	3319, 2019
Reproductive Physiology Research Lab.		1400 Blue Ridge Blvd.	2673, 3849
Teaching Coordinator	R. M. Myers	225 Polk, Box 7621	2764
Architecture			
Head	Robert P. Burns	222 Brooks, Box 7701	2204, 2205, 2206
Asst. Head	Linda W. Sanders	221 Brooks, Box 7701	2204, 2205, 2206
Archives	Maurice S. Toler	G-111 Library, Box 7111	2273
Army ROTC	Col. Martin S. Anderson	160 Reynolds Coliseum, Box 7309	2428
Art			
Curator	Charlotte V. Brown	4110 Univ. Stu. Ctr., Box 7306	3503

Office	Head	Address	Phone
Athletics			
Director	Willis R. Casey	Case Athl. Center, Box 8501	2109
Assoc. Dir.	Frank Weedon	Case Athl. Center, Box 8501	2560
Asst. Dir.	Nora Lynn Finch	Case Athl. Center, Box 8501	2555
Asst. Dir.	Kevin O'Connell	Case Athl. Center, Box 8501	3045
Asst. Dir.	Robert A. Robinson	Case Athl. Center, Box 8501	3315
Asst. to the Dir.	Howard Hink	Case Athl. Center, Box 8501	3382
Asst. to the Dir.	Ray Tanner	103 Reynolds Coliseum, Box 8503	2169
Box Office Mgr.	Bessie Steele	103 Reynolds Coliseum, Box 8503	2106
Business Mgr.	Richard Farrell	103 Reynolds Coliseum, Box 8503	3475
Coliseum Engineer	Bobby Stocks	106 Reynolds Coliseum, Box 8501	2108
Equipment Manager	Dorsey Poole	Weisiger-Brown Athl. Fac., Box 8502	3956
Head Trainer	Craig Sink	Weisiger-Brown Athl. Fac., Box 8502	3960
Sports Information Dir.	Ed Seaman	Case Athl. Center, Box 8501	2102
Wolfpack Club Dir.	Charlie Bryant	College Inn, Box 8602	2112
Baseball	Sam Esposito	Case Athl. Center, Box 8501	3612
Basketball, Men's	James T. Valvano	Case Athl. Center, Box 8501	2104
Basketball, Women's	Kay Yow	Case Athl. Center, Box 8501	2880
Cross Country, Men's & Women's ...	Rollie Geiger	Weisiger-Brown Athl. Fac., Box 8502	3959
Fencing, Men's & Women's	David Porter	Case Athl. Center, Box 8501	2101
Football	Tom Reed	Weisiger-Brown Athl. Fac., Box 8502	2114
Golf, Men's	Richard Sykes	Case Athl. Ctr., Box 8501	3317
Golf, Women's	Fran Allen	Wilmar Golf Club	266-1800
Gymnastics, Men's & Women's ..	Mark Stevenson	Case Athl. Center, Box 8501	2938
Rifle, Men's & Women's	John Reynolds	(after 5:00 p.m.)	872-0544
Soccer, Men's & Women's	Larry Gross	Case Athl. Center, Box 8501	3476
Swimming, Men's & Women's	Don Easterling	Case Athl. Center, Box 8501	2849
Tennis, Men's & Women's	Crawford Henry	122 Reynolds Coliseum, Box 8501	2493
Track	Rollie Geiger	Weisiger-Brown Athl. Fac., Box 8502	3959
Volleyball	Judy Martino	Case Athl. Ctr., Box 8501	3826
Wrestling	Bob Guzzo	Weisiger-Brown Athl. Fac., Box 8502	3548
Audit Div. (Internal), Mgr.	Preston Bethea	B Holladay, Box 7202	3289

B

Biochemistry			
Head	Samuel B. Tove	126 Polk, Box 7622	2581
Biological and Agricultural Engineering			
Head	F. J. Hassler	100 Weaver, Box 7625	2694
Ext. Bio. & Agri. Engr.	Frank J. Humenik	200 Weaver, Box 7625	2675
Biological Sciences Interdepartmental			
Teaching Program Coordinator	C. F. Lytle	2717-A Bostian, Box 7611	3341
Biomathematics Graduate Program (See Statistics)			
Biotechnology Program, NCSU			
Director	Frank B. Armstrong	1 Patterson, Box 7601	7876
Botany			
Acting Head	E. D. Seneca	2214 Gardner, Box 7612	2727
Grad. Administrator	Tommy E. Wynn	2717-B Bostian, Box 7612	3341
Herbarium	James Hardin	3207 Gardner, Box 7612	2700
Budgets			
Director	Roy L. Holley	206 Holladay, Box 7206	2175
Building Services			
.....		3 Park Shops, Box 7219	3323

C

Campus Planning and Construction

Director/Univ. Architect	Edwin F. Harris Jr.	219 Oberlin Rd., Box 7216	2121
Univ. Construction Mgr.	John G. Fields	219 Oberlin Rd., Box 7216	2121
Univ. Landscape Architect	Sallie Ricks	219 Oberlin Rd., Box 7216	2121
Consulting Architect	W. Huntley McKinnon	219 Oberlin Rd., Box 7216	2121
Admn. Asst.	Betty Z. Dunn	219 Oberlin Rd., Box 7216	2121
Capital Assets Accounting Supv.	John G. Hubbard	10 Holladay, Box 7205	2148

Career Planning and Placement Center

Director	Walter B. Jones	28 Dabney, Box 7303	2396
Carter-Finley Stadium			2215, 2218

Central Stores (See Purchases and Stores)

Chancellor's Office

Chancellor	Bruce R. Poulton	A Holladay, Box 7001	2191, 2192
Univ. Counsel	Clauston L. Jenkins Jr.	A Holladay, Box 7001	2319
Sec. of the Univ.	William H. Simpson	A Holladay, Box 7001	2200
Exec. Asst. to the Chancellor	Karen R. Peterson	A Holladay, Box 7001	3062
Admn. Asst.	Thomasene F. Bennett	A Holladay, Box 7001	2191
Director, Institutional Research ..	Richard D. Howard	202 Peele, Box 7002	2776

Chemical Engineering

Head	H. B. Hopfenberg	113 Riddick, Box 7905	2324
Grad. Admin.	R. M. Felder	316 Riddick, Box 7905	3571
Undergrad. Admin.	Hubert Winston	315 Riddick, Box 7905	3572

Chemistry

Head	Kenneth W. Hanck	208-A Dabney, Box 8204	2545
Asst. Head, Facilities & Business Affairs	Marion Miles	525 Dabney, Box 8204	2941
Asst. Head, Graduate Studies ...	Charles G. Moreland	109 Dabney, Box 8204	2548
Asst. Head, Undergrad. Studies	William P. Tucker	108-A Dabney, Box 8204	2546
Supply Room	Curtis G. Harris	314 Dabney, Box 8204	2547

Civil Engineering

Head	Paul Zia	208 Mann, Box 7908	2352
Assoc. Head, Grad. Prog.	Harvey E. Wahls	201 Mann, Box 7908	2331
Assoc. Head, Undergrad. Prog. .	Clinton L. Heimbach	211 Mann, Box 7908	2331
Ctr. for Transportation Engr. Studies	Paul Zia	208 Mann, Box 7908	2331

Climatologist, Office of the State

Coliseum, Reynolds		123 Kilgore, Box 7609	3056
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Coliseum, Reynolds

Director	Willis R. Casey	Case Athl. Center, Box 8501 ...	2109
Box Office Mgr.	Bessie Steele	103 Reynolds Coliseum, Box 8503	2106
Concessions Dir., Univ. Dining		119 Reynolds Coliseum, Box 7218	2123

Computer Graphics Center

Director	Siamak Khorram	338 Daniels, Box 7106	3430
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Computer Science

Dept. Office		122 Daniels, Box 8206	2858
Head	Donald C. Martin	122-C Daniels, Box 8206	7825
Grad. Administrator	David F. McAllister	122-B Daniels, Box 8206	7971
Undergrad. Coordinator	Joyce Hatch	120 Daniels, Box 8206	7027
Grad. Stu. Office		207 Daniels, Box 8206	3195
Grad. Stu. Office		204 Daniels, Box 8206	7938
Leazar Computing Fac.		Lower Level, Leazar, Box 8206	3909

Computer Studies (Grad. Prog.)

Director	Wushow Chou	318 Daniels, Box 8207	2654
Assoc. Director	David F. McAllister	122 Daniels, Box 8207	7971

Computing Center

Director	Carl W. Malstrom	M-2 Hillsborough Bldg., Box 7109	2517
Asst. Dir.	J. Carl Allred	110 Hillsborough Bldg., Box 7109	2517
Administrative Serv.	Betty Strickland	M-2 Hillsborough Bldg., Box 7109	2517

Office	Head	Address	Phone
Business Serv.	Bonnie Hine	B16-B Hillsborough Bldg., Box 7109	2517
Communications & Hardware Serv.	Sam Averitt	109-A Hillsborough Bldg., Box 7109	2517
Operations	George Stancil	107 Hillsborough Bldg., Box 7109	2517
Systems	Larry Roberson	B-15 Hillsborough Bldg., Box 7109	2517
User Serv.	W. Darrell Myrick	1304 Library, Box 7109	2517
Consulting		106 Hillsborough Bldg., Box 7109	3035
Dispatching		126 Hillsborough Bldg., Box 7109	2523
General Info.		M-2 Hillsborough Bldg., Box 7109	2517
Burlington Res. Terminal		1132 Burlington Lab, Box 7109	3165
Daniels Terminal		118 Daniels, Box 7109	3631
Computing Center, Triangle Universities (TUCC) (See Triangle Universities Computation Center)		424 Poe, Box 7801	2681
Computing Facility, Educ.			
Continuing Education, Division of (See Lifelong Education, Division for)			
Contracts and Grants			
Director	Earl N. Pulliam	3 Leazar Lower Level, Box 7214	2153
Cooperating Raleigh Colleges			
Director	Rosalie P. Gates	Johnson Hall	833-6461
		Meredith College, Raleigh	
Cooperative Campus Ministry			
Assemblies of God	Raymond Sowell	P.O. Box 588	755-0928
Baptist	Ted Purcell	Baptist Stu. Ctr.,	834-1875
Catholic	Father Alan Dash	1200 Univ. Stu. Ctr., Box 7306	2414
Episcopal	Bill Brettmann	1200 Univ. Stu. Ctr., Box 7306	2414
Inter-Varsity	Katie Rawson	624-C Smithdale Rd.	832-8875
	Paul Leary	702-C Smithdale Rd.	859-0922
Jewish	Rabbi Martin Beifield	5315 Creedmoor Rd.	781-4895
		27612	
Lutheran	Beverly Alexander	2723 Clark Ave.	828-1433
Methodist	Bill Sharpe	2501 Clark Ave.	833-1861
Metropolitan Community Church	June Norris	1200 Univ. Stu. Ctr., Box 7306	2414
Moravian	Craig Troutman	3225 Darien	787-4034
Presbyterian	W. W. Olney	27 Horne St.	834-5184
	Gail Phares	27 Horne St.	834-5184
United Student Fellowship	Shelton Murphy	3212-D Calumet Dr.	821-1608
Cooperative Education			
Director	William D. Weston	M5 Link, Box 7110	2199
Cooperative Sports Fishery Research			
Leader	M. T. Huish	4105 Gardner, Box 7617	2631
Counseling Center			
Director	M. Lee Salter	200 Harris, Box 7312	2423
Asst. Dir., Counseling	Michael E. Bachman	200 Harris, Box 7312	2423
Counselor Educ.			
Head	Norman A. Sprinthall	520 Poe, Box 7801	2244
Craft Center	Conrad W. Weiser	Thompson Bldg., Box 7305	2457
Creamery	John J. Miles	12 Schaub, Box 7624	2760
Credit Union, State Employees'			
Branch Manager	J. B. Neel	2802 Hillsborough St., Box 8609	2686
Crop Improvement Association			
Director	Foil W. McLaughlin	3709 Hillsborough St., Box 8604	2851
Crop Science			
Head	Billy E. Caldwell	2207 Williams, Box 7620 ..	2647, 2648
Teaching Coord., Grad. and			
Undergrad. Programs	D. A. Emery	2210 Williams, Box 7620 ..	3666, 3667
In Charge, Ext. Crop Science		2212 Williams, Box 7620 ..	2653
Curriculum and Instruction Education			
Head	P. H. Martorella	402-S Poe, Box 7801	3221
Diagnostic Teaching Clinic Coord.	Wendy Sanchez	602-D Poe, Box 7801	7061

Office	Head	Address	Phone
D			
Dairy (See Animal Science and Food Science)			
Dairy Plant	John J. Miles	12 Schaub, Box 7624	2760
Design			
Head	Charles E. Joyner	220-B Brooks, Box 7701	2201, 2202, 2208
Design Library			
Acting Librarian	Caroline Carlton	209 Brooks, Box 7701	2207
Design, School of			
Dean	Claude E. McKinney	200-A Brooks, Box 7701	2201, 2202, 2208
Assoc. Dean	Robert P. Burns	222 Brooks, Box 7701	2204, 2205, 2206
Asst. Dean	Charles E. Joyner	200-B Brooks Box 7701	2201, 2202, 2208
Environ. Simulation Lab	Kenneth Pittman	203 Brooks, Box 7701	3160
Media Center	William K. Bayley	125 Brooks, Box 7701	3785
Design Shop	Terry E. Frye	117 Brooks, Box 7701	2204
Development			
Vice Chancellor	John T. Kanipe Jr.	12 Holladay, Box 7501	2846
Univ. Dev. Officer	John A. Gehrm II	20 Enterprise St., Box 7502	3700
Univ. Dev. Officer	B. Thomas Lawson Jr.	20 Enterprise St., Box 7502	7827, 7846
Univ. Dev. Officer	M. Lynn Lyle	732 Poe, Box 7801	7017
Univ. Dev. Officer	Julia G. May	20 Enterprise St., Box 7502	3700
Univ. Dev. Officer	Frances M. Milks	20 Enterprise St., Box 7502	7827, 7846
Univ. Dev. Officer	Dennis A. Taylor	11 Holladay, Box 7501	2846
Univ. Dev. Officer	Kirke B. Wilcox	102 Page, Box 7901	7458
Univ. Dev. Officer	Paul H. Witham	20 Enterprise St., Box 7502	3700
Univ. Dev. Officer	Robert N. Wood	12 Holladay, Box 7501	2846
Dormitories (See Residence Halls)			
Duplicating Facility, Educ.	Margaret Gray	120 Poe, Box 7801	2231

E

Ecology Committee			
Chairman	A. G. Wollum	3131 Williams, Box 7619	2389
Economics & Business			
Head	D. M. Hoover	201 Patterson, Box 8109	3273
Assoc. Head, Accounting	C. J. Messere	201-F Patterson, Box 8109	3273
Assoc. Head, Agri'l. Res. & Teaching	R. K. Perrin	216 Patterson, Box 8109	2607
Assoc. Head, Econ. & Bus.	J. S. Lapp	201-D Patterson, Box 8109	3273
Assoc. Head & Ext. Specialist-in-Charge	M. A. Johnson	212 Patterson, Box 8109	3107
Asst. Head, Graduate Programs	M. B. McElroy	214 Patterson, Box 8109	2607
Asst. to Head	H. T. Daniel	201-G Patterson, Box 8109	3273
Advisor/Counselor	Bobby Lee Puryear	204 Patterson, Box 8109	3273
Counselor/Placement	Endia B. Hall	204 Patterson, Box 8109	3273
Economic and Business Studies, Center for			
Director	E. W. Erickson	310-B Hillsborough Bldg., Box 8110	2885
Education, School of			
Dean	Carl J. Dolce	208 Poe, Box 7801	2231
Assoc. Dean	H. A. Exum	208 Poe, Box 7801	2231
Assoc. Dean	Robert T. Williams	208 Poe, Box 7801	2231
Dir., Information Systems			
Group	William L. Ballenger	424 Poe, Box 7801	2681
Research and Extension Services	Carl J. Dolce	608 Poe, Box 7801	3127
Curriculum Materials Ctr. Coord.	Margaret A. Link	400 Poe, Box 7801	3191
Instructional Materials Production			
Ctr. (IMPC) Coord.	W. S. Burke	511 Poe, Box 7801	3054
Education Foundation Inc.	M. Lynn Lyle	732 Poe, Box 7801	7017
Educational Leadership & Prog. Eval.	Bruce G. Beezer	608 Poe, Box 7801	3127

Office	Head	Address	Phone
Electrical and Computer Engineering			
Head	N. A. Masnari	232 Daniels, Box 7911	2336
Assoc. Head, Undergrad. Admin.	W. T. Easter	232 Daniels, Box 7911	2336
Graduate Admin.	J. F. Kauffman	238 Daniels, Box 7911	2336
Coord., Advising	J. Larson	233 Daniels, Box 7911	2336
Dir., Ctr. for Communications & Signal Processing	S. Chitsaz	320 Daniels, Box 7914	3015
Electron Microscopy Center	J. M. Mackenzie Jr.	1223 Gardner, Box 7615	2664
Engineering Operations Program			
Director	F. M. Richardson	Page, Box 7901	2315
Engineering Research Services Division			
Director	M. A. Littlejohn	Page, Box 7903	2345, 3328
Engineering, School of			
Dean	Larry K. Monteith	102 Page, Box 7901	2312
Assoc. Dean, Graduate Programs	J. K. Ferrell	224 Page, Box 7901	2345
Assoc. Dean, Research Programs	T. S. Elleman	224 Page, Box 7903	2345
Assoc. Dean, Undergrad. Programs ..	George F. Bland	116 Page, Box 7904	3693
Dir., Academic Affairs		116 Page, Box 7901	2315
Dir., Admin. Services	Jemma S. Rayfield	101 Page, Box 7901	2310
Dir., Continuing Services	Robert M. Turner	115 Page, Box 7901	3263
Dir., Minority Student Services	Bobby Pettis	115 Page, Box 7904	3264
Dir., Special Services	Byard Houck	115 Page, Box 7904	2341
Communications	Mary Yionoulis	6 Page, Box 7901	3848
Co-operative Education	George F. Bland	115 Page, Box 7904	2300
Publications	Martha K. Brinson	7 Page, Box 7901	2310
(For engineering departments, look under individual listing: Biological and Agricultural, Chemical, Civil, Electrical, Industrial, Materials, Mechanical and Aerospace, and Nuclear.)			
Engineering Writing Assistance Program	Gary Blank	118 Page, Box 7901	3545
English			
Dept. Office		Tompkins, Box 8105	3866
Head	John E. Bassett	131-B Tompkins, Box 8105	2462
Assoc. Head and Dir., Undergrad. Prog.	Jack D. Durant	131-G Tompkins, Box 8105	3353
Asst. Head, Scheduling	Marilyn M. Brandt	131-F Tompkins, Box 8105	3353
Dir., Freshman Prog.	Lucinda H. MacKethan	237 Tompkins, Box 8105	3353
Dir., Graduate Prog.	Mary C. Williams	131-E Tompkins, Box 8105	3353
English Education	Ruie Pritchard	408 Poe, Box 7801	3221
Entomology			
Head	Ronald J. Kuhr	2301 Gardner, Box 7613	2746
Ext. Entomology	P. Sterling Southern	2309 Gardner, Box 7613	2703, 2831
Environmental Projects	David Adams	139 Harrelson, Box 7107	2470, 2891
Extension			
Vice Chancellor for Extension & Public Service	W. L. Turner	200 McKimmon, Box 7401	2144
Assoc. Vice Chan. & Dir., Ctr. for Urban Affairs	Grover J. Andrews	202 McKimmon, Box 7401	3373
Asst. to Vice Chan.	Mary Frances Hester	204-A McKimmon, Box 7401	3373

F

Faculty Club			
Manager	Harry E. Anderson	4200 Hillsborough St., 27606, Box 8611	828-0308
Faculty Senate			
Chairman	Sondra L. Kirsch	2319 Library, Box 7111	2279
Fellows Program, North Carolina State	Gerald G. Hawkins	210 Harris, Box 7316	3151
Fiber and Polymer Science Program	William K. Walsh	107-B Nelson, Box 8301	3057
Film Library, Agricultural Extension		Ricks Annex, Box 7603	2861
Finance and Business			
Vice Chancellor, Fin. and Bus.	George Worsley	B Holladay, Box 7201	2155

Office	Head	Address	Phone
Assoc. Vice Chancellor, Fin. and Bus.	Lauren J. Brisky	B Holladay, Box 7201	2732
Asst. Vice Chancellor, Bus.	Charles D. Leffler	203 Holladay, Box 7228 ..	2146, 2147
Asst. Vice Chancellor, Fin.	Darryl W. Bierly	B Holladay, Box 7201	2143
Financial Aid			
Director	Carl O. Eycke	213 Peele, Box 7302	2421, 2448
Assoc. Dir.	Paul D. West Jr.	213 Peele, Box 7302	2421, 2448
Asst. Dir.	Wanda Abdullah	213 Peele, Box 7302	2421, 2448
Asst. Dir.	Elizabeth Vann	213 Peele, Box 7302	2421, 2448
Asst. Dir.	Florence I. Francis	213 Peele, Box 7302	2421, 2448
Asst. Dir.	Rosa Hinton	213 Peele, Box 7302	2421, 2448
Asst. Dir., Scholarship Coord.	Patricia J. Lee	205 Peele, Box 7302	3671
Asst. Dir.	Mary F. Usry	213 Peele, Box 7302	2421, 2448
Food Science			
Head	D. R. Lineback	100-C Schaub, Box 7624	2951
Teaching Coord., Grad. & Undergrad. Programs	V. A. Jones	100-D Schaub, Box 7624	2952
In Charge, Ext. Food Science	N. C. Miller Jr.	129-B Schaub, Box 7624	2956
Creamery	John J. Miles	12 Schaub, Box 7624	2760
Foreign Languages and Literatures			
Dept. Office		126-A 1911 Bldg., Box 8106 ..	2475
Head	Joan H. Stewart	122 1911 Bldg., Box 8106	3343
Asst. Head	Lina Cofresi	126 1911 Bldg., Box 8106	2475
Scheduling Officer	Sofus Simonsen	129 1911 Bldg., Box 8106	2475
Language Lab.	Edward M. Stack	302 Harrelson, Box 8106	3358
Teacher Educ.	Arlene Malinowski	113 1911 Bldg., Box 8106	2475
Spanish/Business Prog.	Ruth Adler	131 1911 Bldg., Box 8106	2475
Language Festival	Gilbert Smith	119 1911 Bldg., Box 8106	2475
ESL Prog.	Virginia Prichard	304 Harrelson, Box 8106	3297
Forest Resources Library	John Abbott	4012 Biltmore, Box 8001	3513
Forest Resources, School of			
Dean	Eric L. Ellwood	2028-H Biltmore, Box 8001	2883, 2884
Assoc. Dean, Acad. Aff.	LeRoy C. Saylor	2028-C Biltmore, Box 8001	2883
Assoc. Dean, Research	E. B. Cowling	2028-F Biltmore, Box 8001	2883
Forestry Extension, In Charge	Michael P. Levi	3036-D Biltmore, Box 8003	3386, 3387
Forestry			
Head	Arthur W. Cooper	2018-E Biltmore, Box 8002	2892
Foundation Seed Producers, Inc.			
Manager	M. W. Baker	4025 Beryl Rd., Box 8603	2821
Foundations Accounting & Investments			
Director	Paulette E. Jervay	B Holladay, Box 7207	2110
Foundations (See Development)			
Fraternities—Interfraternity Council			
President	Bowen Ross	214 Harris, Box 7314	2441
Alpha Gamma Rho	Walter Hill	2304 Hillsborough St.	821-7410
Alpha Phi Alpha	Laric Copes	27607 1402 Varsity Dr.	839-1657
Alpha Sigma Phi	Jay Jackson	27606 10 Enterprise St.	828-5025
Delta Sigma Phi		27607 Box 5566, 27607	772-9887
Delta Upsilon	Brad Gibson	3 Maiden Ln., 27607	834-9255
Farmhouse	Chris Hood	115 Park Ave., 27605	832-0886
Kappa Alpha	Chip Wood	2601 W. Fraternity Ct. ...	833-4271
Kappa Alpha Psi	Ronald Byrd	27606 214 Harris	2441
Kappa Sigma	Allen Roper	2613 W. Fraternity Ct. ...	832-3812
Lambda Chi Alpha	Todd Beine	27606 108 S. Fraternity Ct.	832-5634
Omega Psi Phi	Richard Dowdy	27606 214 Harris	2441
Phi Beta Sigma	Barry Blackwell	214 Harris	2441
Phi Kappa Tau	James Briggs	2511 W. Fraternity Ct. ...	828-7625
		27606	

Office	Head	Address	Phone
Pi Kappa Alpha	Todd Woodard	214 S. Fraternity Ct.	828-7641
Pi Kappa Phi	Donald Arant	2401 W. Fraternity Ct.	755-9996
Sigma Alpha Epsilon	David Adams	2701 W. Fraternity Ct.	834-3455
Sigma Alpha Mu	David Weems	2501 W. Fraternity Ct.	828-8153
Sigma Chi	Mike Wallace	2409 W. Fraternity Ct.	833-7811
Sigma Nu	Robert Peele	204 S. Fraternity Ct.	832-1172
Sigma Phi Epsilon	David Eckles	100 S. Fraternity Ct.	832-4118
Sigma Pi	Landon Elmore	Box 5656, Clark Ave.	833-5116
Tau Kappa Epsilon	David Moretz	2619 W. Fraternity Ct.	833-6926
Theta Chi	Rick Jorgenson	20 Maiden Ln., 27607	834-3585
Theta Tau	William Walker	2707 Vanderbilt Ave.	828-2730
Zeta Beta Tau	Eric McKinney	214 Harris	2441
Freight Office	Ray Lawhorn	Central Stores, Box 7225	2211
Friends of the College	Henry Bowers	Univ. Stu. Ctr., Box 7306	2835, 2452
Furniture Mfg. & Mgmt. In Charge	C. Thomas Culbreth	341 Riddick, Box 7906	3335, 3338

G

Gas Chromatograph/Mass Spectrometer Facility Lab Supv.	Carol A. Haney	1141 Burlington, Box 7003	3746
Genetics Acting Head	Dale F. Matzinger	3513 Gardner, Box 7614	2292
Graduate School		Box 7102	2871, 2872
Vice Provost and Dean	Jasper D. Memory	103 Peele, Box 7102	2394
Assoc. Dean	R. E. Fornes	203 Peele, Box 7102	7052
Assoc. Dean	D. W. Stewart	203 Peele, Box 7102	7052
Assoc. Dean	A. M. Witherspoon	115 Peele, Box 7102	7461
Grad. Stu. Assoc.	Joye Bennett	520 Poe, Box 7801	2244
Graphic Communications, Occup. Educ. Coord.	Garland Hilliard	510-N Poe, Box 7801	2234
Grounds Superintendent	Frank Bynum	Morris Bldg., Box 7219	3401

H

Health Occupations, Occup. Educ. Coord.	Judith A. Davis	510-C Poe, Box 7801	2234
Health Services (Student) Information		Clark Inf., Box 7304	2563, 2564
Director	Jerry Barker	200 Clark Inf., Box 7304	2562
Coord., Health Educ. Progs.	Marianne Turnbull	200 Clark Inf., Box 7304	2563
History Head	Burton F. Beers	157 Harrelson, Box 8108	3383
Home Economics Extension	Martha R. Johnson	107 Ricks, Box 7605	2781
Foods and Nutrition	Nadine F. Tope	F-4 Ricks Annex, Box 7605	2770
Human Environment	Judy Mock	F-1 Ricks Annex, Box 7605	2770
Horticultural Science Head	A. A. De Hertogh	120 Kilgore, Box 7609	3131
Grad. Program Coord.	F. L. Haynes Jr.	214 Kilgore, Box 7609	3167
Undergrad. Teaching Coord.	W. E. Ballinger	114 Kilgore, Box 7609	3189
Ext. Horticulture	G. R. Hughes	160 Kilgore, Box 7609	3321

Office	Head	Address	Phone
Housing			
Director		204 Harris, Box 7315	3047
Asst. Dir., Administration	Toni McNaughton	206 Harris, Box 7315	2419
Asst. Dir., Facilities	Jeff Compher	206 Harris, Box 7315	2410
Asst. Dir., Operations	Cheryl DiBucci	205 Harris, Box 7315	2419
Student Housing Administrator	Norma McDonald	201 Harris, Box 7315	2440
Accounting Technician	Jackie Sloan	207 Harris, Box 7315	3337
Off-Campus Housing		201-A Harris, Box 7315	3821
Resid. Hall Assignments		201 Harris, Box 7315	2440, 2449
Resid. Hall Repairs		206 Harris, Box 7315	2410
Resid. Hall Keys		205 Harris, Box 7315	2419
Summer Conference Housing		205 Harris, Box 7315	2419
Human Resources			
Director	Alice R. Miller	Primrose, Box 7210	2973
Asst. Dir., Employment Services	John C. Brooks	Primrose, Box 7210	2137
Asst. Dir., Mgmt. & Emp. Develop.	Robert P. Allen	Primrose, Box 7210	7844
Asst. Dir., Pos. Mgmt. & Sal. Admin.	Stephen E. Davis	Primrose, Box 7210	7175
Mgr., Salary Administration	E. Ann Peters	Primrose, Box 7210	7929
Mgr., Univ. Temp. Service	Kathy Scaringelli	Primrose, Box 7210	7060
Humanities and Social Sciences, School of			
Dean	William B. Toole III	106 Link Bldg., Box 8101	2467
Assoc. Dean	M. Mohan Sawhney	106 Link Bldg., Box 8101	2468
Asst. Dean	G. David Garson	M-7 Link Bldg., Box 8101	2467
Asst. Dean	Edith D. Sylla	106 Link Bldg., Box 8101	2467
Dir., Coop. Educ.	William D. Weston	M-6 Link Bldg., Box 7110	2199
Dir., Hum. Comp. Lab.	G. David Garson	109 Tompkins, Box 8101	7880
Dir., Hum. Ext.	Elliot Engel & Joseph Mastro	M-4 Link Bldg., Box 8101	3451
Dir., Media Services	Ronald Kemp	G116 Tompkins, Box 8181	3334
Dir., N.C. Japan Center	John Sylvester Jr.	5 Rosemary St., Box 8112	3450
Dir., Social Sci. Res. & Instructional Comp. Lab.	G. David Garson	221 Winston, Box 8101	3791
Acad. Coord., Minority Stu.	Joan S. Griffin	286 Tompkins, Box 8101	7456
Coord., Evening Prog.	Lynda H. Hambourger	G103C Tompkins, Box 8101	3638
I			
Industrial and Technical Educ. Prog., Occup. Educ.			
Acting Coordinator	J. R. Clary	502-L Poe, Box 7801	2234
Industrial Arts Educ. Prog.			
Coordinator	Richard E. Peterson	300 Poe, Box 7801	2234
Industrial Engineering			
Head	Thom J. Hodgson	328 Riddick, Box 7906	2362
Asst. Head & Coord., Advising ..	Clarence L. Smith Jr.	334 Riddick, Box 7906	2362
Grad. Administrator	Richard G. Pearson	349 Riddick, Box 7906	2362, 3086
Furniture Manufacturing and Management Program	C. Thomas Culbreth	341 Riddick, Box 7906	3335
Industrial Extension Service			
Dir., Engr. Ext. Education	Daniel E. Harrell	203-A Page, Box 7902	2356
Dir., Indus. Ext. & App. Res. ..	Thomas W. Stephenson	215-C Page, Box 7902	3262
Infirmary (See Health Services)			
Information Center (Student Addresses)			
Information Services (News Service)		Univ. Stu. Ctr., Box 7306	3138
Director	Lucy Coulbourn	219 Oberlin Rd., Box 7504	3470
Asst. Dir., News	Rosalind Reid	219 Oberlin Rd., Box 7504	3470
Asst. Dir., Spec. Projs	Robert S. Cairns III	219 Oberlin Rd., Box 7504	3470
Information Systems Group (See Education, Sch. of)			
Information, Visitor Parking			
Institute of Statistics			
Director	Daniel L. Solomon	110-A Cox, Box 8203	2420
Institutional Research			
Director	Richard D. Howard	202 Peele, Box 7002	2776
Asst. Dir.	Brenda Rogers	202 Peele	2776
International Programs			
	J. Lawrence Apple	209 Daniels, Box 7112	3201

Office	Head	Address	Phone
International Student Office			
International Student Adviser	Donald R. Roberts	1201 Univ. Stu. Ctr., Box 7306	.2961
Asst. International Student Adviser	Judith A. Green	1201 Univ. Stu. Ctr., Box 7306	.2961
International Trade Center	Charles A. Shields	213 McKimmon, Box 7401	.3793

K

King Village (See Student Family Housing)

L

Landscape Architecture			
Head	Arthur L. Sullivan	223 Brooks, Box 7701	.2204, 2205, 2206
Laundry and Dry Cleaning			
Manager	Lawrence W. Gower	Laundry, Box 7218	.2122
Library, D. H. Hill			
Dir. of Libraries	I. T. Littleton	1208 Library, Box 7111	.2843, 2595
Asst. Dir., General Serv.	Donald S. Keener	1318 Library, Box 7111	.2843, 2595
Asst. Dir., Reference Serv.	William C. Lowe	1128 Library, Box 7111	.2935
Asst. Dir., Technical Serv.	Nell Waltner	1137 Library, Box 7111	.2841
Binding	Phyllis Garriss	G-116 Library, Box 7111	.2842
Circulation Desk	Bonnie Baker	1212 Library, Box 7111	.3364
Collection Dev.—Acquisitions	Margaret R. Hunt	3136 Library, Box 7111	.3833
General Services	Linda P. Fuller	1209 Library, Box 7111	.3364
Interlibrary Center	Ann Baker Ward	1133 Library, Box 7111	.2116
Library Systems	William C. Horner	2312 Library, Box 7111	.2339
Media Center Office	Pam Fleming	2305 Library, Box 7111	.2977
Monographic Cataloging	Walter M. High	1121 Library, Box 7111	.2603
Periodicals Serv. Center	Elizabeth Chiego	G-114 Library, Box 7111	.3136
Photocopy	Sharon Wells	1222 Library, Box 7111	.2343
Reference-Information	W. Robert Pollard	1131 Library, Box 7111	.2935
Reserve Room	Frieda Stamper	1330 Library, Box 7111	.2597
Serials	Gloria W. Houser	G-116 Library, Box 7111	.2842
Technical Info. Ctr.	M. Ronald Simpson	1129 Library, Box 7111	.2830
U. S. Documents	Jean Porter	2108 Library, Box 7111	.3280
Lifelong Education, Division for			
Director (Con. Educ. & Professional Dev.)	Kelly R. Crump	147-I McKimmon, Box 7401	.3007
Assoc. Dir.	Denis S. Jackson	225 McKimmon, Box 7401	.2277
Asst. Dir. (Credit Branch)	John F. Cudd Jr.	145-C McKimmon, Box 7401	.2265

M

Mail Room		Leazar	.3974
Marine, Earth and Atmospheric Sciences			
Head	L. Jay Langfelder	216 Withers, Box 8208	.3717
Grad. Admin.	G. S. Janowitz	228-G Withers, Box 8208	.7837
Undergrad. Admin.	C. D. Harrington	204 Withers, Box 8208	.7049
Atmospheric Sciences		214 Withers, Box 8208	.3711
Earth Sciences		214 Withers, Box 8208	.3711
Marine Sciences		214 Withers, Box 8208	.3711
Marriage Counseling			
Counselors	Cranor F. Graves, Molly H. Glander	200 Harris, Box 7312	.2423
Married Student Housing (See Student Family Housing)			
Materials Engineering			
Head	John J. Hren	229 Riddick, Box 7907	.3568
Materials Research Center			
Director	Robert F. Davis	141-A Riddick, Box 7907	.3272

Office	Head	Address	Phone
Mathematics			
Head	E. E. Burniston	360-A Harrelson, Box 8205	3798
Assoc. Head	J. B. Wilson	252 Harrelson, Box 8205	2382, 2383
Dir., Grad. Prog.	J. E. Franke	224 Harrelson, Box 8205	3200
Dir., Undergrad. Prog.	M. J. Evans	202 Harrelson, Box 8205	2382, 2383
Assoc. Dir., Grad. Prog.	G. D. Faulkner	225 Harrelson, Box 8205	3261
Audio-Visual Tutorial Center		244 Harrelson, Box 8205	3157
Director	R. G. Savage	235 Harrelson, Box 8205	3157
Scheduling Officer	J. A. Marlin	306 Harrelson, Box 8205	3796
Mathematics and Science Education			
Head	Ann C. Howe	326-S Poe, Box 7801	2239
Center for Research in Mathematics & Sci. Educ.		326 Poe, Box 7801	2239
McKimmon Center			
Director	Denis S. Jackson	225 McKimmon, Box 7401	2277
Reservationist	Diane Outlaw	225 McKimmon, Box 7401	2277
Facilities Coord.	Jane E. Hodge	139 McKimmon, Box 7401	2277
Mechanical and Aerospace Engineering			
Head	John A. Bailey	3211 Broughton, Box 7910	2365, 2366
Grad. Admin.	J. C. Mulligan	3175 Broughton, Box 7910	2365
Undergrad. Admin.	A. S. Boyers	3179A Broughton, Box 7910	2365
Dir., Applied Energy Research Lab.	J. A. Edwards	Ligon St., Box 7910	3912
Dir., Ctr. for Sound and Vib.	T. H. Hodgson	2229 Broughton, Box 7910	3024
Dir., Integrated Manufacturing Systems Engr. Inst.	A. C. Eberhardt	2332 Broughton, Box 7915	3808
Dir., Precision Engr. Lab.	T. A. Dow	4216 Broughton, Box 7910	3024
Mentor Program			
Director		206 Peele, Box 7317	3835
Merit Awards Program			
Coordinator	Patricia J. Lee	205 Peele, Box 7302	3671
Microbiology			
Head	L. W. Parks	4515-B Gardner, Box 7615	2391
Biological Nitrogen Fixation Prog.	G. H. Elkan	Method Rd., Box 7615	3281
Electron Microscopy Center	J. M. Mackenzie Jr.	1233 Gardner, Box 7615	2664
Middle School Education Program	John Arnold	402 Poe, Box 7801	3221
Military Property Custodian	Linda Evans	145 Reynolds Coliseum, Box 7308	2427
Motor Pool	Gayle Franks	Motor Pool Bldg., Box 7219	2179
Music			
Director	J. Perry Watson	203 Price Music Ctr., Box 7311	2981
Mycotoxin Lab	W. M. Hagler Jr.	Univ. Res. Farm #6, Varsity Dr., Box 7608	2729, 3228

N

Navy ROTC	Lt. Edward Henkler	304 Reynolds Coliseum, Box 7310	2907
News Services (See Information Services)			
North Campus Bookshop	Jean P. Emerson	Erdahl-Cloyd Annex, Box 7224	3831
North Carolina Japan Center	John Sylvester Jr.	5 Rosemary St., Box 8112	3450
North Carolina Vocational Assn.	Bill Maness	510-D Poe, Box 7801	2494
Nuclear Engineering			
Head	Paul J. Turinsky	1110-B Burlington, Box 7909	2301, 2302
Nuclear Reactor Program			
Director		2116 Burlington, Box 7909	2322, 2530
Nutrition Program			
Coordinator	H. A. Ramsey	303 Polk, Box 7621	2766

O

Occupational Education			
Head	Joseph R. Clary	502-L Poe, Box 7801	2234
Agri'l. Educ. Coord.	L. R. Jewell	602-M Poe, Box 7801	2234
Graphic Comm. Coord.	Garland K. Hilliard	510-N Poe, Box 7801	2234
Health Occupations Educ. Coord.	Judith A. Davis	510-C Poe, Box 7801	2234
Indus. Arts Educ. Coord.	Richard E. Peterson	300 Poe, Box 7801	2234
Indus. & Tech. Educ. Acting Coord.	Joseph R. Clary	502-L Poe, Box 7801	2234
Off-Campus Housing			
Operations Research			
Chairman	Salah E. Elmaghraby	201-A Harris, Box 7315	3821
		322-A Riddick, Box 7914	2350

P

Parking Services			
Payroll and Benefits			
	Ruth Ellis	100 Coliseum, Box 7222	2120, 3269
Peace Corps Recruiter			
Personnel Services (See Human Resources)			
Pest Management Curriculum (IPM)			
Coordinator	Blanche C. Haning	Leazar, Lower Level, Box 7215	2151
Pesticide Residue Research Laboratory		1 Patterson, Box 7601	3818
Director	T. J. Sheets	2705 Bostian, Box 7613	3341
Philosophy and Religion			
Head	Robert S. Bryan	3709 Hillsborough St., Box 8604	3391
Photographic Services			
Physical and Mathematical Sciences, School of			
Dean	Garrett Briggs	100 Winston, Box 8103	2477
Assoc. Dean, Academic Affairs	Robert D. Bereman	Ricks Annex, Box 7603	2861
Assoc. Dean, Research	Leslie B. Sims	118 Cox, Box 8201	7277
Physical Education			
Dept. Office		122-A Cox, Box 8201	7833
		113 Cox, Box 8201	7865
Locker Room			
Physical Plant			
Director	Charles C. Braswell	2000 Carmichael, Box 8111	2487, 2488
Asst. Dir., Engineering	Carl D. Fulp	2002 Carmichael, Box 8111	3361
Asst. Dir., Gen. Serv.	Gary Y. Coates	2012 Carmichael, Box 8111	3161, 3162
Asst. Dir., Oper.	Lawrence B. Bradley	Box 8111	3508
Asst. Dir., Veterinary Serv.	W. D. Brazeal	101 Morris, Box 7219	2181
Asst. to Dir.	Page Billingsley	9-A Morris, Box 7219	2181
Admn. Serv. Supt.	George F. Lynch	103 Morris, Box 7219	2181
Auto. Serv. Supt.	F. Randy Bowen	109 Morris, Box 7219	2181
Boiler House (nights, weekends, holidays—emergencies—Vet School)		4700 Hillsborough St., Box 8401	829-4217
Budget	Edward B. Phillips	101 Morris, Box 7219	2181
Bldg. Services Supt.	Berry Dunston	200-B Morris, Box 7219	2180
Const. & Estimating Supt.	Glenn O. Ervin	Motor Pool Bldg., Box 7219	2179
Design Serv. Supt.	Lyn E. Adams	209 Morris, Box 7219	2180
Elect. Syst. Supt.	David S. Taylor	4 Park Shops, Box 7219	3323
Landscape Serv. Supt.	Frank B. Bynum Jr.	115 Morris, Box 7219	3448
Management Engr.	Richard Hardee	7-A Morris, Box 7219	2184
Mech. Syst. Supt.	Lewis M. Strong	16 Morris, Box 7219	2184
Motor Pool	Gayle Franks	Land. Serv. Bldg., Box 7219	3401, 3408
Personnel	Bobby F. Holloway	109-B Morris, Box 7219	2181
Steam Utility Supt.	C. Tommy Barefoot	17 Morris, Box 7219	2184
		Motor Pool Bldg., Box 7219	2179
		204-C Morris, Box 7219	2180
		13 Morris, Box 7219	2181

Office	Head	Address	Phone
Trade Serv. Supt.	Roy Munden	2 Park Shops, Box 7219	3323
Training	Kenneth C. Mayer	109-B Morris, Box 7219	2181
Work Center/Scheduling Officer ..	Jennifer F. Burdick	128 Morris, Box 7219	2991
Physical Sciences Research			
Director	Leslie B. Sims	115 Cox, Box 8201	7865
Physics			
Head	R. R. Patty	105 Cox, Box 8202	2521, 2522
Graduate Administrator	G. E. Mitchell	106 Cox, Box 8202	2521, 2522
Physiology Program			
Coordinator	J. H. Britt	231 Polk, Box 7621	2768
Phytotron (S. E. Plant Env. Lab)			
Director	R. J. Downs	2003 Gardner, Box 7618	2778
Placement (See Career Planning and Placement)			
Plant Pathology			
Dept. Office		2518 Gardner, Box 7616	2735, 2736, 2737
Head	William L. Klarman	2518 Gardner, Box 7616	2730
Ext. Plant Pathology	H. E. Duncan	1410 Gardner, Box 7616 ..	2711, 2712
Plant Disease & Insect Clinic		1300 Gardner, Box 7616	3619
Graduate Student Offices		3419 Gardner, Box 7616	3753
Int'l. Meloidogyne Contract Lab ..		1415 Gardner, Box 7616	3488
Biological Sciences Greenhouse			3137
Air Quality Field Research Lab	A. S. Heagle	3908 Inwood Rd., Unit #2	3728
840 Method Road	K. R. Barker	Unit #2, Box 7628	3330
840 Method Road	D. M. Benson	Unit #3, Box 7629	3966
840 Method Road	R. A. Reinert	Unit #3, Box 7629	3962
840 Method Road	S. R. Shafer	Unit #2, Box 7628	2142
Plant Sci. Res., USDA	D. P. Schmitt	3127 Ligon St., Box 7631	3905
Tobacco Headhouse			3306
Police—Campus	Communications Ctr.	Field House, Box 7220	3333
Political Science and Public Administration			
Acting Head	Robert O. Tilman	215 Link, Box 8102	2481, 2482
Asst. Head, Scheduling Officer	John H. Gilbert	217 Link, Box 8102	2481, 2482
Dir., MPA Prog.	Erika S. Fairchild	220 Link, Box 8102	2481, 2482
Dir., Criminal Justice Option	Joel B. Rosch	229 Link, Box 8102	2481, 2482
Dir., Law & Political Philosophy			
Concentration	Sanford H. Kessler	208 Link, Box 8102	2481, 2482
Dir., Undergrad. Advising	John H. Gilbert	217 Link, Box 8102	2481, 2482
Coord., Undergrad. Internships ..	Jackson M. McClain	207 Link, Box 8102	2481, 2482
Coord., Grad. Internships and			
Placement	Elizabethann O'Sullivan	219 Link, Box 8102	2481, 2482
Poultry Science			
Head	James E. Marion	120 Scott, Box 7608	2626
Ext. Poultry Science	T. A. Carter	208 Scott, Box 7608	2621
Premedical Program			
Chairman		1628 Gardner, Box 7617	2402
Product Design			
Head	Vincent M. Foote	220 Brooks, Box 7701	2204, 2205, 2206
Productivity Research and Extension Program (PREP)			
Dir.	William A. Smith Jr.	324 Riddick, Box 7906	733-2370
Program Office		3114 Univ. Stu. Ctr. Box 7306	2451, 2453
Provost and Vice Chancellor's Office			
Provost and Vice			
Chancellor	Nash N. Winstead	109 Holladay, Box 7101	2195
Assoc. Provost	Murray S. Downs	103 Holladay, Box 7101	2194
Assoc. Provost and Affirmative Action			
Officer/Compliance Officer			
for Title IX	Lawrence M. Clark	201 Holladay, Box 7101	3148
Asst. Provost for Academic			
Computing	Henry E. Schaffer	M2A Hillsborough Bldg. Box 7109	2516
Psychology			
Head	Paul W. Thayer	640-D Poe, Box 7801	2251
Public Administration Program	Erika S. Fairchild	220 Link, Box 8102	2481, 2482

Office	Head	Address	Phone
Public Safety			
Emergency			3333
Director	Chief James W. Cunningham	101 Field House, Box 7220	2157
Deputy Dir., Admin.	Capt. Miles J. Heckendorn III	103 Field House, Box 7220	2156
Deputy Dir., Operations	Capt. Larry D. Liles	103 Field House, Box 7220	3206
Interim Deputy Dir., Life Safety Services	Bruce L. Macdonald	105-A Field House, Box 7220	2568
Auxiliary Functions Coord.		103 Field House, Box 7220	2156
Auxiliary Functions Sgt.	Sgt. Joellen M. Nader	103 Field House, Box 7220	2156
Support Services Coord.	Lt. Terry Abney	103 Field House, Box 7220	2156
Support Services Sgt.	Sgt. C. Renee Wood	103 Field House, Box 7220	2156
Crime Prevention Officer	Ptl. Penelope H. McLeod	103 Field House, Box 7220	2156
Investigations	Det./Sgt. Laura K. Reynolds	103 Field House, Box 7220	2498
Hazardous Waste Spec.	Robert V. Ginnis	105-A Field House, Box 7220	2999
Bio-Safety Officer		105-A Field House, Box 7220	2568
OSHA Consultant		105-A Field House, Box 7220	2568
Sr. Life Safety Inspector	Floyd S. Sellers	105-A Field House, Box 7220	2568
Shift Commanders	Sgt. William F. Bowden	103 Field House, Box 7220	3206
	Sgt. Teresa Crocker	103 Field House, Box 7220	3206
	Sgt. Robyn G. Lee	103 Field House, Box 7220	3206
	Sgt. Wesley J. Shattuck	103 Field House, Box 7220	3206
Publications, Agri'l. Ext. and			
Agri'l. Res. Serv.	Thomas W. Knecht	318 Ricks, Box 7603	3173
Publications, Student			
	Lynn Wallace	3134 Univ. Stu. Ctr., Box 7306	2413
	Rodney Woodlief	3134 Univ. Stu. Ctr., Box 7306	2413
Pulp and Paper Science	R. G. Hitchings	2106 Robertson, Box 8005	2888
Purchases and Stores			
Director	Ed Sikoski	214 Alumni, Box 7212	2171
Systems Coord./Supv.	Linda Allred	216 Alumni, Box 7212	2171
Admn. Asst.	Katherine Suggs	216 Alumni, Box 7212	2171
Stores Operations Mgr.	Roger Duckett	Central Stores, Box 7225	2198
Stores Office Mgr.	Judy Willis	Central Stores, Box 7225	2198
Stores Sales Mgr.	Arthur Bradford	Central Stores, Box 7225	2230
Purchasing Officer	Bob Knoll	201 Alumni, Box 7212	2171
Purchasing Officer	Matthew Mills	206 Alumni, Box 7212	2171
Purchasing Officer	Felton Tilley	200 Alumni, Box 7212	2171
Purchasing Officer	Annette Wahab	204 Alumni, Box 7212	2171
Purchasing Agent	Mary Sanders	210 Alumni, Box 7212	2171
Purchasing Agent	Richard Williams	200-A Alumni, Box 7212	2171
Interior Designer	Brigette Pollock	200 Alumni, Box 7212	2171
Status Information			2171

R

Radiation Protection Office			
Radiation Protection Officer	D. W. Morgan	214 Clark Labs., Box 7108	2894
Assoc. Radiation Protection Officer	D. B. Beasey	214 Clark Labs., Box 7108	2894
Chairman, Radiation Protection Council	J. A. Mulholland	125 Harrelson, Box 8108	2365
Radio Station			
WKNC-FM	Chrystal Bartlett	3122 Univ. Stu. Ctr., Box 8607	2400
Reading Education Program Coordinator	Barbara J. Fox	402 Poe, Box 7801	3221
Recreation Resources Administration Head	M. Roger Warren	4008-C Biltmore, Box 8004	3276
Registration and Records			
Univ. Registrar	James H. Bundy	100 Harris, Box 7313	2576
Asst. Registrar	Donald E. Patty	100 Harris, Box 7313	2572
Asst. Registrar	Martha M. Welch	100 Harris, Box 7313	2576
Readmissions		100 Harris, Box 7313	2572

Office	Head	Address	Phone
Scheduling (Classrooms)	Anita Hanover	100 Harris, Box 7313	2577
Student Records & Transcripts		100 Harris, Box 7313	2572
Veterans Affairs		100 Harris, Box 7313	3048
Religious Affairs (See Cooperative Campus Ministry)			
Research			
Vice Chancellor	Franklin D. Hart	208 Daniels, Box 7003	2117
Assoc. Dean	Howard W. Etzel	208 Daniels, Box 7003	2117
Admn. Officer	Linda F. Jackson	211 Daniels, Box 7003	2444
Biotechnology Program, NCSU	Frank B. Armstrong	1 Patterson, Box 7601	7876
GC/MS Facility	Carol A. Haney	1141 Burlington, Box 7003	3746
Sponsored Funds Info. Ctr.	Diane M. Banasz	211 Daniels, Box 7003	2444
Technology Admin.	Becky R. French	200-B Daniels, Box 7003	2355
Residence Halls			
Alexander	Scotti Holcombe	Alexander, Box 7315	2925
Bowen		Bowen, Box 7315	2901
Bragaw	Michael Blackwell	Bragaw, Box 7315	2903
Carroll	Sylvia Bittle	Carroll, Box 7315	2905
Lee	Susan Johnson	Lee, Box 7315	2900
Metcalf		Metcalf, Box 7315	2908
Middle East (Syme, Gold, Welsh)		Syme, Box 7315	3605
North		North, Box 7315	3651
Owen		Owen, Box 7315	2924
Quad (Berry, Becton, Bagwell)		Berry, Box 7315	2923
South	Iris Hunt	South, Box 7315	2792
Sullivan		Sullivan, Box 7315	2921
Tucker		Tucker, Box 7315	2922
Turlington	Cecil McManus	Turlington, Box 7315	2929
Residence Life			
Director	Cynthia P. Bonner	208-A Harris, Box 7315	2406
Assoc. Dir.	Susan Manley Randell	208 Harris, Box 7315	2406
Assoc. Dir., Supervision	Michael Gilbert	208 Harris, Box 7315	2406
Asst. Dir., Policy Enforcement & Staff Selection	Elizabeth Pawlicki	208 Harris, Box 7315	2406
Asst. Dir., Programming	Audrey Jones	208 Harris, Box 7315	2406
Assoc. Dir.	David Stuckey	Alexander, Box 7315	2087
Preceptor	Susan Hubbell	Berry, Box 7315	2353
Coord., Residential Scholars Prog.	Alex Miller	102 Sullivan, Box 7315	2353
ROTC (See Air Force, Army and Navy)			

S

Sea Grant College Program, UNC			
Director	B. J. Copeland	105 1911 Bldg., Box 8605	2454
Assoc. Dir.	Ronald G. Hodson	105 1911 Bldg., Box 8605	2454
Dir., Communications	Kathy Hart	105 1911 Bldg., Box 8605	2454
Dir., Marine Advisory Serv.	James D. Murray	105 1911 Bldg., Box 8605	2454
Snack Bar Operations	Walter E. Barkhouse	Quad, Box 7307	2124
Bragaw Snack Bar	Barbara Okoh	Bragaw, Box 7307	3095
Erdahl-Cloyd Annex	Randy Lait	Erdahl-Cloyd Annex, Box 7307	3270
McKimmon Ctr. Snack Bar	Janet Throne	McKimmon Ctr., Box 7307	3090
Quad Snack Bar	Marilyn Atkins	Quad, Box 7307	2124
Shuttle Inn	Rose Stewart	Nelson, Box 7307	2128
Syme Snack Bar	Sallie Lane	Syme, Box 7307	2127
Tunnel Inn	Madeline Carter	SSS Bldg., Box 7307	2166
Social Studies Education	Charles Harper	408 Poe, Box 7801	3221
Sociology and Anthropology			
Acting Head	C. Paul Marsh	301 1911 Bldg., Box 8107	3180, 3114
Interim Asst. Head	Mary L. Walek	306 1911 Bldg., Box 8107	3114
Ext. Spec.-in-Charge	Maurice E. Volland	237 1911 Bldg., Box 8107	2670
Grad. Administrator	Robert L. Moxley	315 1911 Bldg., Box 8107	2702, 2610
Dir., Social Work	P. Nelson Reid	334 1911 Bldg., Box 8107	3291, 3299
Soil Science			
Head	R. H. Miller	2234 Williams, Box 7619	2655, 2656

Office	Head	Address	Phone
Academic Programs		2228 Williams, Box 7619	2643
Extension Programs	J. V. Baird	1225 Williams, Box 7619	3285
International Programs	P. A. Sanchez	3104 Williams, Box 7619	2838
Solar House		Box 7401	3799
Sororities			
Panhellenic Council	Tammy Crews	214 Harris, Box 7314	2441
Alpha Delta Pi	Stacy Brewer	2709-B W. Fraternity Ct. .	834-1550
		27606	
Alpha Kappa Alpha	Nicole Brown	214 Harris, Box 7314	2441
Alpha Xi Delta	Wendy Adler	214 Harris, Box 7314	2441
Chi Omega	Wendy Jones	1616 Crest Rd.,	782-3796
		27606	
Delta Sigma Theta	Melanie Streeter	214 Harris, Box 7314	2441
Sigma Kappa	Leanne Karn	2709-A W. Fraternity Ct., .	833-4710
		27606	
Southeastern Plant Environment Lab. (see Phytotron)			
Southern Engineer		10 Page, Box 7901	2240
Special Education Program			
Coordinator	Cathy L. Crossland	402 Poe, Box 7801	3221
Speech-Communication			
Head	William J. Jordan	206 Winston, Box 8104	2450,
			3204, 3247
Asst. Head	Raymond S. Rodgers	214-A Winston, Box 8104	2450,
			3204, 3247
Speech, Hearing and Language			
Clinic	Gail Schumacher	222 Winston, Box 8104	3767,
			2450, 3204
Speech-Communication Audio	James Alchediak	2316-B Library, Box 8104	3303
	Edward Funkhouser	2316 Library, Box 8104	3303
	Robert Schrag	207 Winston, Box 8104	2450
Sports Information (Varsity)			
Dir.	Ed Seaman	Case Athl. Ctr., Box 8501	2102
State Employees' Credit Union (See Credit Union)			
'Statelogs'	Ruth Hutchison	219 Oberlin Rd., Box 7504	3470
Statistics			
Dept. Office		110 Cox, Box 8203	2528
Head	Daniel L. Solomon	110- A Cox, Box 8203	2420
Grad. Administrator	Thomas M. Gerig	111 Cox, Box 8203	2528
Undergrad. Administrator	John L. Wasik	614-F Cox, Box 8203	2532
Biomathematics Graduate Program		513 Cox, Box 8203	2271
Grad. Stu. Offices		5th Floor Cox, Box 8203	2543
Grad. Stu. Offices		6th Floor Cox, Box 8203	3925
Grad. Stu. Offices		8th Floor Dabney, Box 8203 ..	2489
Student Accounts (Tuition & Fees)			
Director	W. R. Styons	2 Peele, Box 7213	2986
Cashiers	Paulette Kearney	2 Peele, Box 7213	2988
	Jerry LaGarde	2 Peele, Box 7213	2988
Loan Section	James Sweet	2 Peele, Box 7213	2985
Student Address Information (See University Student Center)			
Student Affairs			
Vice Chancellor	Thomas H. Stafford Jr.	101 Holladay, Box 7301	2446
Asst. to Vice Chan. for Stu. Affairs			
Univ. Dining	Arthur L. White	4109 Univ. Stu. Ctr., Box 7307 .	3090
Assoc. Vice Chan.	Henry Bowers	Univ. Stu. Ctr., Box 7306	2452
Assoc. Vice Chan.	Ronald C. Butler	205 Peele, Box 7317	2962
Assoc. Vice Chan.	Gerald G. Hawkins	210 Harris, Box 7316	3151
Assoc. Vice Chan.	Charles A. Haywood	209 Harris, Box 7316	3499
Student Center (See University Student Center)			
Student Development			
Director	Evelyn Reiman	212 Harris, Box 7314	2441
Asst. Dir.	Michael Borden	220 Harris, Box 7314	2441
Asst. Dir.	Robert S. Bryan Jr.	214 Harris, Box 7314	2441
Asst. Dir., Legal Services	Sonja Beckham	216 Harris, Box 7314	2963
Frat. Ct. Manager	Andrew Smith	220 Harris, Box 7314	2441
Student Employment (part-time work) Counselor	Mary Usry	216 Peele, Box 7302	2421

Office	Head	Address	Phone
Student Family Housing			
Coord.	Bob Paisley	E.S. King Vlg., Box 7315	2430
Student Government			
President, Student Body	Jay Everette	4130 Univ. Stu. Ctr., Box 7306 ..	2797
President, Student Senate	Gary Mauney	4130 Univ. Stu. Ctr., Box 7306 ..	2797
Treasurer	Marva Hardee	4130 Univ. Stu. Ctr., Box 7306 ..	2797
Attorney General	Jeff Ross	4130 Univ. Stu. Ctr., Box 7306 ..	2797
Student Publications (See Publications)			
Student Records and Transcripts		100 Harris, Box 7313	2572
Students Supply Stores			
Director	G. Robert Armstrong	SSS Bldg., Box 7224	2161, 3117
Assoc. Director	Douglas Small Jr.	SSS Bldg., Box 7224	2161, 3117
Book Division Mgr.	Thomas V. Setzer	SSS Bldg., Box 7224	3117
Book Div. Asst. Mgr.	Donald Bonnewell	SSS Bldg., Box 7224	3117
Book Sales Floor Supv.	Raymond Wanchock	SSS Bldg., Box 7224	3117
Merchandise & Mktg. Div. Mgr.	Richard Hayes	SSS Bldg., Box 7224	2161
Computer Sales	Clarence Morgan	SSS Bldg., Box 7224	2161
General Mdse.	Edith Purvis	SSS Bldg., Box 7224	2161
Supplies	Edward York	SSS Bldg., Box 7224	2161
Operations Division Mgr.	James Garrison	SSS Bldg., Box 7224	2161
North Campus Bookshop Supv.	Ada Braswell	Erdahl-Cloyd Annex, Box 7224 ..	3831
Personnel Mgr.	Aline Roberson	SSS Bldg., Box 7224	2161
Accounting Supv.	Mary Sigmon	SSS Bldg., Box 7224	2161
Study Abroad	Dave Stuckey	105 Alexander	2087
Summer Institute in English for Speakers of Other Languages			
Director	Virginia M. Prichard	134 Harrelson, Box 8106	3297
Summer Sessions			
Director	John F. Cudd Jr.	145-C McKimmon, Box 7401 ..	2265
Asst. Dir.		145-E McKimmon, Box 7401 ..	2265

T

Technical Information			
Center	M. Ronald Simpson	1129 Library, Box 7111 ..	2839, 2830
Technician			
Editor	Barry Bowden	3120 Univ. Stu. Ctr., Box 8608 ..	2411
Technology Administration			
Director	Becky R. French	200-B Daniels, Box 7003	2355
Telecommunications			
Director	Miriam Tripp	108 Winston, Box 7217	7046
Office Mgr.	Olive A. Stone	112 Winston, Box 7212	2141
Television (UNC Center for Public Television)			
Production Coord.	Richard Snavely	211-A Television Ctr., Box 8601	2853
Textile Chemistry			
Head	C. D. Livengood	115 Clark Labs, Box 8302	2551
Asst. Head & Grad. Admin.	G. N. Mock	115 Clark Labs, Box 8302	2551
Textile Engineering and Science			
Head	S. P. Hersh	102 Nelson, Box 8301	3253
Assoc. Head & Grad. Admin.	B. S. Gupta	108 Nelson, Box 8301	3253
Textile Management and Technology			
Head	G. A. Berkstresser	201-C Nelson, Box 8301	3442
Asst. Head & Acad. Coord.	M. L. Robinson	144 Nelson, Box 8301	3485
Grad. Admin.	P. A. Tucker	B-49 Nelson, Box 8301	3469
Textiles Extension			
Assoc. Director	L. T. Lassiter	B-22 Nelson, Box 8301	3469
Textiles, School of			
Dean	D. S. Hamby	101 Nelson, Box 8301	3231
Assoc. Dean	P. L. Grady	107 Nelson, Box 8301	3059
Assoc. Dean, Academic Programs	M. H. Mohamed	126 Nelson, Box 8301	3485
Assoc. Dean, Textile Research & Graduate Studies	W. K. Walsh	107-B Nelson, Box 8301	3057

Office	Head	Address	Phone
Asst. to the Dean for Student Serv. & Placement Dir.	W. E. Smith	120 Nelson, Box 8301	3780
Textiles Library	Barbara Best-Nichols	112 Nelson, Box 8301	3043
Theatres			
Director	Charles A. Martin Jr.	Univ. Stu. Ctr., Box 7306	3927
Center Stage		Univ. Stu. Ctr., Box 7306	3900
Stewart		Univ. Stu. Ctr., Box 7306	3104
Thompson		Thompson Bldg., Box 7305	2405, 3147
Tobacco Literature Service	Pamela E. Puryear	2314 Library, Box 7111 ..	2836, 2837
Toxicology Program			
Chairman	Ernest Hodgson	1519 Gardner, Box 7613	2274
Transcripts and Student Records		100 Harris, Box 7313	2572
Transportation			
Director	Janis Y. Rhodes	5 Field House, Box 7221	3424
Parking Serv.		100 Coliseum, Box 7222 ..	3269, 2120
Visitor Info. Center		Info. Center, Box 7221	3205
Travel Audit			
Supv.	Tassie Brooks	5 Holladay, Box 7204	3152
Triangle Universities			
Computation Center	Leland H. Williams	Box 12076, Res. Tri. Park	549-0671
TV, Closed Circuit Prog.	Lee Downs	2324 Library, Box 7111	3895

U

University Cashier	Paulette Kearney Jerry LeGarde	2 Peele, Box 7213	2988
University Dining		2 Peele, Box 7213	2988
Asst. to Vice Chan. for Stu.			
Aff. for Univ. Dining	Arthur L. White	4109 Univ. Stu. Ctr., Box 7307 ..	3090
Dir., Operations	Walter E. Barkhouse	Quad, Box 7307	2124
Business Manager	Verna Wentz	3102 Univ. Stu. Ctr., Box 7307 ..	3090
Asst. Dir., Univ. Stu. Ctr.	David Rittenhouse	Univ. Stu. Ctr., Box 7307	3090
Dir. Concessions		119 Reynolds Coliseum	2123
Dir., Contract Dining Ser.	Zeph Putnam	Dining Hall, Box 7307	3963
Dir., Reservations & Catering	Lucie R. Hunter	2102 Univ. Stu. Ctr., Box 7307 ..	3090
University Graphics			
Manager	Scott G. Bertness	Univ. Graphics, Box 7226	2131
Production Mgr.	Glenn G. Sanderson	Univ. Graphics, Box 7226	2131
Copy Center Mgr.	Melody S. West	108 Parks Shops, Box 7226	3460
University Relations			
Director	Albert B. Lanier Jr.	17 Holladay, Box 7501	2850
Dir., Information Serv.	Lucy Coulbourn	219 Oberlin Rd., Box 7504	3470
Univ. Publ. Coord.		17 Holladay, Box 7501 ..	2850, 3452
Asst. Vice Chan., Comm.	Hardy D. Berry	20 Enterprise St., Box 7502 ...	3700
University Research Units			
Supt.-In-Charge	H. V. Marshall Jr.	108 Patterson, Box 7601	2823
Unit 1	J. S. Starr	4616 Reedy Crk. Rd.	2713
Unit 2	K. M. Snyder	3720 Lake Wheeler Rd.	2759
Weather Data .....		.....	833-9949
Unit 4	John Scott	4301 Beryl Rd.	3144
University Student Center			
Director	Henry Bowers	Univ. Stu. Ctr., Box 7306	2452
Assoc. Dir.	Lee R. McDonald	Univ. Stu. Ctr., Box 7306	2558
Asst. Dir., Univ. Dining	David Rittenhouse	Univ. Stu. Ctr., Box 7307	3090
Craft Shop Dir.	Conrad W. Weiser	Thompson Bldg., Box 7305	2457
Curator of Art	Charlotte V. Brown	Univ. Stu. Ctr., Box 7306	3503
Program Office		3114 Univ. Stu. Ctr., Box 7306	2451, 2453
Reservations	Lucie R. Hunter	Univ. Stu. Ctr., Box 7306	2249
Student Address & Info.	Information Center	Univ. Stu. Ctr., Box 7306	3138
Student Center President	John Higdon	Univ. Stu. Ctr., Box 7306	2453

Office	Head	Address	Phone
University Studies, Division of			
Head	John M. Riddle	144 Harrelson, Box 7107	.2479, 2470
University Temporary Service			
Manager	Kathy Scaringelli	Primrose, Box 7210	.....7060, 7066
Upward Bound Dir.	Cynthia J. Harris	205 Peele, Box 7317	.....3632
Counselor		205 Peele, Box 7317	.....3632
Urban Affairs and Community Services, Center for			
Director	Grover J. Andrews	202 McKimmon, Box 7401	.....3373
USDA-ARS—Agricultural Research Service			
Location Leader	D. E. Moreland	4123 Williams, Box 7620	.....2661
Admn. Officer	E. J. Foley	51 Kilgore, Box 7610	.....2731
Air Quality—Plant Growth &			
Development Res.	W. W. Heck	1509 Varsity Dr., Box 7620	.....3311
Boll Weevil Eradication Res.	W. Dickerson	4116 Reedy Creek Rd.,	.....3560
		27607	
Food Sci. Res.	H. P. Fleming	322-A Schaub, Box 7624	.....2979
Forage Res.	J. C. Burns	1316 Williams, Box 7620	.....2657
Plant Physiology &			
Photosynthesis Res.	D. E. Moreland	4123 Williams, Box 7620	.....2661
Plant Sci. Res.	C. W. Stuber	3627 Gardner, Box 7614	.....2289
Market Quality & Handling Res.	J. W. Dickens	126 Weaver, Box 7625	.....3101
Soybean & Nitrogen Fixation Res.	R. F. Wilson	4114-B Williams, Box 7620	.....3267

V

Veterans Affairs		100 Harris, Box 73133048
Veterinary Anatomy, Physiological Sciences & Radiology			
Head	A. L. Aronson	4700 Hillsborough St.,	
		Box 8401829-4220
Veterinary Companion Animal & Special Species Medicine			
Head	S. W. Crane	4700 Hillsborough St.,	
		Box 8401829-4230
Veterinary Food Animal & Equine Medicine			
Head	W. D. Oxender	4700 Hillsborough St.,	
		Box 8401829-4240
Veterinary Medical Library			
Librarian	T. J. Fischer	4700 Hillsborough St.,	
		Box 8401829-4219
Veterinary Medicine, School of			
Operator/Information829-4200
Dean	T. M. Curtin	4700 Hillsborough St.,	
		Box 8401829-4210
Business Officer	J. W. Green	4700 Hillsborough St.,	
		Box 8401829-4214
Academic Affairs			
Assoc. Dean & Dir.	D. R. Howard	4700 Hillsborough St.,	
		Box 8401829-4212
Admissions Dir.	M. C. Motley	4700 Hillsborough St.,	
		Box 8401829-4205
Biomedical Communications Dir.	P. J. Difatta	4700 Hillsborough St.,	
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		Box 8401829-4280
Veterinary Equine Research Ctr.	Clifton McLean	Southern Pines692-8773

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Bovine & Swine	R. F. Behlow	204 Polk, Box 7621	2566
Poultry	J. R. Harris	214 Scott, Box 7608	2621
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Boiler House (nights, weekends or holidays)			829-4216
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		If no answer	829-9536
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Central Crops Research Station (NCNU)	553-6468
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Weather Data	553-4810
Hatteras Marine Res. Station	
Dir.—W. W. Hassler, Box 615, Hatteras 27943	
Horticultural Crops Research Station (NCNU)	675-2314
Supt. T.L. Blake, Rt. 2, Box 610, Castle Hayne 28429	
Weather Data	675-9949
Horticultural Crops Research Station (NCDA)	592-7839
Supt.—Fred E. Cumbo, Rt. 5, Box 43, Clinton 28328	
Weather Data	592-1697
Lower Coastal Plain Tobacco Research Station (NCNU)	527-3579
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Supt.—Harley E. Blackwell, Rt. 2, Fletcher 28732	
Weather Data	704-687-1994
Mountain Research Station (NCDA)	704-456-3943
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Peanut Belt Research Station (NCDA)	348-2213
Supt.—Stephen C. Herlocker, Box 220, Lewiston 27849	
Weather Data	348-2255
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Upper Mountain Research Station (NCDA)	982-2501
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Macon—County Courthouse & Admin. Bldg.	
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Dan E. Baucom, Jacksonville	455-5873
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T. S. Baker, Box 818, Asheboro	629-2131

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John G. Richardson, Box 2280, Lumberton	738-8111
Rockingham—County Center	
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Rowan—1216 W. Innes St.	
J. Harold Caudill, Box 1807, Salisbury	704-633-0571
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G. E. Biddix Jr., Rutherfordton	704-287-2211
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Scotland—County Govt. Center	
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Young, Dr. James H., (Lou), Prof. Bio. & Agri'l. Engr. 127 Weaver, Box 7625; 4104 Pepperton Dr., 27606	3101	851-5099
Young, Dr. James N., (Noel), Prof. Emer., Soc. & Anth. 1005 Canberra Pl., Florence, SC 29501		803-667-6754
Young, Malpheus F., (Carol), Res. Tech., Crop Sci., USDA 3127 Ligon St., Box 7631; 3200 Campbell Rd., 27606	3905	851-0919
Young, Dr. Margaret S., (Ervin H.), Assoc. Prof., Comp. Ani. & Sp. Species Med.—SVM 4700 Hillsborough St., Box 8401; 5106 Tudor Pl., Durham 27713	829-4231	544-4864
Young, Dr. Robert V., (Suzanna), Assoc. Prof., Engl. 244 Tompkins, Box 8105; Rt. 1, Box 284-A3, Apex 27502	3870	362-5540
Young, Dr. Talmage B., (Kathryn), Assoc. Prof. Emer., Occup. Educ. 300 Poe; 5249 Vann St., 27606	2234	851-3961
Youngblood, Anderson G., Res. Aide, Poul. Sci. Univ. Res. Farm #2, Box 7608; 821-A Barringer Dr., 27606	3446	851-1374
Younts, Bryce R., (Hazel), Dir., Alumni Rel. Alumni, Box 7503; 3712 Eakley Ct., 27606	3375	851-0235
Yow, S. Kay, Women's Basketball Coach, Athl. 2A Case Athl. Ctr., Box 8501; 1407 Laughridge Dr., Cary 27511	2880	467-2655
Yu, Nancy R., (Tim), Monographic Cat. Librn., Libr. 1121 Library, Box 7111; 8508 Southfield Pl., 27614	2603	847-9991

Z

Zack, Thomas W., (Ashlee), Micro-Lab. Supv., For. Resou.	3276	847-5704
3016 Biltmore, Box 8001; 11609 Strickland Rd., 27612		
Zeidman, Rebecca G., (Steve), Admn. Sec., Comp. Sci.	7926	
122-A Daniels, Box 8206; 1150 Nottingham Cir., Cary 27511		
Zeiger, Dr. Donald C., Assoc. Prof. Emer., Hort. Sci.		
Box 7609; 623 Lennox Pl., Hendersonville 28739		
Zelbisky, Sherrie, Food Serv. Supv., Univ. Dining	3963	
Dining Hall, Box 7307		
Zeleniak, Nancy E., Asst. Dir., Sports Info., Athl.	2102	
Case Athl. Ctr., Box 8501; 105 S. Dixie Tr., 27607		
Zering, Dr. Kelly D., (Patricia Cowper), Asst. Prof., Ext. Ec. & Bus.	3884	851-6950
213-C Hillsborough Bldg., Box 8110; 737 Grove Ave., 27606		
Zia, Dr. Paul Z., (Dora), Prof. & Head, Civil Engr.	2352	787-6583
208 Mann, Box 7908; 2227 Wheeler Rd., 27607		
Zimmerman, Clementine F., (Harold), Res. Tech., Plant Path.	2751	833-0515
3405 Gardner, Box 7616; 439 Glenbrook Dr., 27610		
Zingraff, Dr. Matthew T., (Rhonda), Assoc. Prof., Soc. & Anth.	3114	834-9896
312 1911 Bldg., Box 8107; 600 Beaver Dam Rd., 27607		
Zobel, Dr. Bruce J., (Barbara), Prof. Emer., For.	3410	851-3156
1019 Biltmore, Box 8002; Rt. 4, Box 441, 27606		
Zorowski, Dr. Carl F., (Louise), R. J. Reynolds Prof., Mech. & Aero. Engr.	3241	787-0937
4154 Broughton, Box 7910; 4513 Pitt St., 27609		
Zorowski, Kristine A., Patrol Off., Public Safety	3206	
103 Field House, Box 7220		
Zuckerman, Dr. Gilroy J., (Cindy), Prof., Ec. & Bus.	3884	467-2174
211-D Hillsborough Bldg., Box 8110; 1010 Sturdivant Dr., Cary 27511		
Zumwalt, Dr. Lloyd R., (Joan), Prof. Emer., Nuc. Engr.	2304	834-3195
3124 Burlington, Box 7909; 10 Dixie Tr., 27607		

UNIVERSITY COMMITTEES

1985-1986

AD HOC COMMITTEE FOR THE HANDICAPPED

Faculty and Staff:

Lyn E. Adams
William L. Ballenger
Patricia A. Davis
Cheryl A. DiBucci
Harold C. Griffin
Rae J. Kelly
Sotello V. Long
W. Huntley McKinnon
Conrad H. Miller
Robert Owens
Frank J. Pozo

Student Members:

Derik Davis
Kenny Kirk
Mary Menetrez
Denise Murray

Ex officio:

Lawrence M. Clark
Rachel Dupree

Sandra O. Paur
Wilma C. Peebles
LeRoy C. Saylor
Thomas H. Stafford Jr.
William B. Toole III
Nellie L. Waltner
Augustus M. Witherspoon

ART ACQUISITIONS

Faculty:

J. J. Perry, *Chair*
Leonidas J. Betts
Lina L. Cofresi
David N. Hyman, *Senate*
Jerome Kohl
Julia G. May
Hayne Palmour
Michael Pause
Donald G. Simmons

Ex officio:

Charlotte Brown
Lucy Coulbourn
Claude E. McKinney
1 Student Member

ADMISSIONS

Faculty:

Harry B. Moore, *Chair*
Kenneth R. Barker, *Senate*
John K. Coster
Thomas Johnson
Myron W. Kelly
David B. Marsland
Arthur B. Moss
Jae Y. Park
Wilma C. Peebles
Robert M. Turner

Ex-officio:

Dir. of Admission (Anna P. Keller)

Student Members:

Shawn A. Donsch
Clarence M. Hauer

ATHLETICS COUNCIL

Faculty:

	Term Expires
Richard D. Mochrie, <i>Chair</i>	1986
Lawrence M. Clark	1986
Roger H. Clark, <i>Senate</i>	1986
Julie G. McVay	1986
Frederick O. Smetana	1988
Beth E. Wilson	1987
Augustus M. Witherspoon	1987

Alumni:

G. Brantley DeLoatch	1986
Kenneth L. Johnson	1987
James E. Stewart	1988

Student Members:

Jeffrey L. Mangum	1986
Gary V. Mauney	1987
Anne Marie Treadway	1987

Ex officio:

Chancellor (Bruce R. Poulton)
Athletics Director (Willis R. Casey)

AFFIRMATIVE ACTION

Faculty and Staff:

Lawrence M. Clark, *Chair*
Robert D. Bereman
Gordon A. Berkstresser
George Bland
Terrence M. Curtin
Deborah Dalton
Carl J. Dolce
Marie Green
Francis J. Hassler
Mary Frances Hester
Katherine Klein
J. E. Legates
Nancy B. Martin
Alice R. Miller

BIOSAFETY

Faculty:

Frank B. Armstrong, *Chair*
Glenn C. Bewley
Frederick J. Fuller
R. L. Hoffman
B. L. Macdonald
William L. Miller
Ralph L. Mott

Ex officio:

Franklin D. Hart, *Research*
Philip B. Carter, *Senate*

Community:

William H. Wilson (*N. C. Medical Care Commission*)
Isaac Wright (*N. C. Department of Human Resources*)

CAMPUS STORES

Faculty:

Nicholas J. Rose, *Chair*
Duane F. Neuman
Raymond Saxe, *Senate*

Ex officio:

Asst. Vice Chancellor for Business (Charles Leffler)
3 Student Members

CHANCELLOR'S ADVISORY COUNCIL ON AFRO-AMERICAN AFFAIRS

Faculty and Staff:

Bob Allen
Edgar Farmer
Wandra Hill
Sotello Long
Hubert Winston
Tommy Wynn

Ex officio:

Assoc. Prov. & Affirm. Action Rep.
(Lawrence M. Clark)
Assoc. Graduate Dean (Augustus M. Witherspoon)
Student Members:
Andrew Barner
Dennis Hatchett
Susan Smith

CHANCELLOR'S ADVISORY COUNCIL ON WOMEN'S AFFAIRS

Faculty and Staff:

Frances M. Richardson, *Chair*
Yvonne S. Brannon
Molly H. Glander
Gail W. O'Brien
Beulah M. Parker
Mary C. Williams
2 Student Members

COMMENCEMENT:

Faculty:

Don C. Locke, *Chair*
Milton Bliss
M. M. Sawhney
Jack L. Shannon
L. George Wilson, *Senate*

Ex officio:

Elizabeth Poulton
Liaison/Student Affairs (Ronald C. Butler)
3 Student Members

COMMITTEE ON COMMITTEES

(All members Ex officio)

Provost, *Chair* (Nash N. Winstead)
Assoc. Provost (Murray S. Downs)
Chm., *Fac. Sen.* (Sondra L. Kirsch)
Immed. Past Chair, *Fac. Sen.* (Robert M. Fearn)
Vice Chm., *Fac. Sen.* (James E. Smallwood)
Vice Chan., *Stu. Aff.* (Thomas H. Stafford Jr.)

COURSES AND CURRICULA

Faculty:

Robert S. Sowell, *Chair*
David A. Adams
Walter E. Ballinger
John E. Bassett
James L. Cole
David F. Culken
C. R. Gould
Joyce Hatch, *Senate*
Kerry S. Havner
Burton L. Russell
William C. Stuckey
Paul Tesar
Hubert Winston

Ex officio:

Assoc. Provost (Murray S. Downs)

EXTENSION, LIFELONG EDUCATION AND INSTRUCTIONAL TELEVISION

Faculty:

Woodrow E. Robbins, *Chair*
Robert D. Dahle
James K. Ferrell
John Fetrow
Linda P. Fuller
Edward T. Funkhauser
Robert B. Hazel
David M. Jenkins
Judieth E. Mock, *Senate*
Thomas L. Russell
Gary W. Smith
Joan W. Wright

Ex officio:

University Extension (Grover Andrews)
Computing Center (Samuel Averitt)
2 Student Members

**FACULTY HOSPITALITY
AND ORIENTATION**

Faculty:
Jerry M. Daniels, *Chair*
Donald Barnes
Janice R. Christensen
Cheryl A. DiBucci
David E. Guinnup
Larry R. Jewell
Carolyn S. Love
Thomas O. Manning
Jon Mauney
Gary N. Mock, *Senate*
Jean M. Porter
Sofus Simonsen
Patricia Tector, *Woman's Club Rep.*
Ex officio:
Elizabeth Poulton
Liaison, Chancellor's Off. (William H. Simpson)

FEE APPEALS

Faculty:
Bruce G. Beezer, *Chair*
T. W. Evans
Awatif E. Hassan, *Senate—Spring '86*
Thomas W. Joyce, *Senate—Fall '85*
Mary L. Walek
Ex officio:
Dir., Stu. Accts. (William R. Styons)
Housing (William W. Guy)
Registration (Martha M. Welch)
2 Student Members

O. MAX GARDNER AWARD

Faculty:
Peter R. Lord, *Chair*
William R. Carter
John K. Coster, *Senate*
Charles B. Davey
Frank E. Guthrie
Donald R. Howard
Gerald Lucovsky
Gene Namkoong
J. Ben O'Neal Jr.

GOVERNMENT

<i>Faculty:</i>	Term Expires
Richard D. Mochrie, <i>Chair</i>	1986
L. Raymond Camp	1986
Robert M. Fearn	1988
Sarah A. Rajala	1988
Linda W. Sanders	1987
Mohan Sawhney	1987

**GRADUATE SCHOOL
ADMINISTRATIVE BOARD**

<i>Faculty:</i>	Term Expires
Jasper D. Memory, <i>Chair</i>	
Raymond E. Fornes	
Debra W. Stewart	
Augustus M. Witherspoon	
Robert D. Bereman	1986
David R. Buchanan	1988
Ellis B. Cowling	1987
Cathy L. Crossland	1987
Fred R. DeJarnette	1985
Donald A. Emery	1985
Erika S. Fairchild	1988
J. K. Ferrell	1986
H. Robert Horton	1987
Linda L. Jewell	1987
Donald G. Simmons	1988
Oscar Wesler	1987
<i>Faculty Senate</i> (Thomas W. Reiland)	
<i>Graduate Student Assn.</i> (Joye Bennett)	
<i>Research</i> (Howard W. Etzel)	

**GROUP INSURANCE AND
BENEFITS**

Faculty and Staff:
R. David Mustian, *Chair*
A. C. Barefoot
Page Billingsley
Curtis Fitzgerald
William S. Galler
Hassan A. Hassan
Bobby F. Holloway
John P. Huggard
Margaret R. Hunt
Rosemark King
Allison R. Manson
Joe A. Marlin, *Senate*
LeRoy B. Martin
Glenn C. McCann
Katie B. Perry
E. Ann Peters
Reggie J. Powell
Paul S. Stone
Paul W. Thayer
Richard J. Thomas

Ex officio:
Payroll & Benefits Officer (Ruth Ellis)
Rep., Provost's Off. (Henry Schaffer)
Agri'l. Ext. Rep. (Martha R. Johnson)
Health Services, Student Affairs (Jerry Barker)
Retired Faculty (David W. Chaney)

HARRELSON FUND

Faculty:

Harvey J. Charlton, *Chair*
Subhash K. Batra
Ann C. Howe
Jonathan K. Ocko, *Senate*
Robert C. Serow
James C. VanderKam

Ex officio:

Student Affairs (Henry Bowers)
2 Student Members

INSTITUTIONAL HISTORY AND COMMEMORATION

Faculty:

Doris E. King, *Chair*
Walter M. High, *Senate*
Ronald E. Kemp
H. Rooney Malcom Jr.
Julie G. McVay
Marion L. Miles
James V. Pressley
Odell Uzzell

Ex officio:

Asst. Dir., Info. Serv. (Robert Cairns)
Dir., Spec. Proj., Univ. Relations
Vice Chancellor, Development (John T.
Kanipe Jr.)
Univ. Archives (Maurice S. Toler)
Dir., Alumni Rel. (Bryce R. Younts)
Dir., Univ. Rel. (Albert B. Lanier Jr.)
7 Students Members (2 *Ex officio*)

INTERNATIONAL PROGRAMS

Faculty:

Arthur L. Sullivan, *Chair*
L. Raymond Camp, *Senate*
G. L. Carter
David J. DeMaster
R. Alan Donaldson
Richard R. Johnson
Richard A. King
Jan Laarman
Daniel C. Richardson
Pedro A. Sanchez
Ronald E. Stinner
James M. Wallace

Ex officio:

Coord., Int'l. Progs. (Lawrence Apple)
Dir., N. C. Japan Center (John Sylvester Jr.)
Graduate Sch. (Augustus M. Witherspoon)
Int'l. Stu. Adv. (Donald Roberts)
Rep., Stu. Aff. (David J. Stuckey)
2 Student Members

KEY HAVEN

Faculty:

R. C. Axtell, *Chair*
Shoshana Serxner, *Treasurer*
William M. Adams
Glen R. Bathke
George A. Cummings
D. Michael Jackson
Richard J. Leuba
Ralph McGregor
John S. Strenkowski
Douglas A. Williams

Ex officio:

Vice Chancellor, Business (Charles Leffler)

LABORATORY ANIMAL CARE AND FACILITIES

Faculty:

	Term Expires
C. W. McPherson, <i>Chair</i>	1986
G. L. Catignani	1986
R. E. Cook	1988
Ernest Hodgson	1987
T. E. LeVere	1986
W. L. Miller	1987
H. A. Underwood	1986
M. S. Young	1986

Ex officio:

Vice Chancellor, Research (Frank Hart)

LIBRARY

Faculty:

Eleanor F. Weinell, *Chair*
Herman A. Berkhoff
Joseph W. Cunningham
Joseph M. Doster
Richard D. Gilbert
Larry F. Grand
F. Joseph Hale, *Senate*
Suzanne T. Purrington
P. Nelson Reid
Charles M. Stanislaw

Ex officio:

Dir., Libraries (I. T. Littleton)
5 Student Members

PATENTS AND COPYRIGHTS

Faculty and Staff:

Franklin D. Hart, *Chair*
Winser Alexander
Leory Coggins
Clauston Jenkins
William H. Johnson
Earl N. Pulliam
John S. Risley
William K. Walsh

Ex officio:

Becky French

PHYSICAL ENVIRONMENT

Faculty and Staff:

Paul Cribbins, *Chair*
Angelo Abbate
Bonnie L. Baker
Kenneth R. Barker
Berry Dunston
Mary Gray
Stephen E. Margolis
Robert Nagle
Phillip S. Rea
Roger P. Rohrbach, *Senate*
Stephen Schecter
Jo Warren

Ex officio:

Dir., Campus Plan. & Const. (Edwin F. Harris Jr.)
Dir., Phys. Plant (Charles C. Braswell)
Dir., Trans. (Janis Rhodes)
Stu. Aff. (Gerald Hawkins)
Rep., Univ. Planning Committee (Charles Moreland)
6 Student Members

RADIATION PROTECTION COUNCIL

Faculty and Staff:

	Term Expires
James A. Mulholland, <i>Chair</i>	1987
Lawrence M. Ballas	1988
Betty L. Black	1986
Lawrence H. Bowen	1988
Richard D. Gilbert	1986
Daniel L. Grosch	1987
Ralph McGregor, <i>Senate</i>	1986
Michael R. Metcalf	1988
J. Richard Mowat	1988
John F. Roberts, <i>Vice Chair</i>	1988
Raymond Saxe	1986

Ex officio:

Rad. Prot. Officer (D. William Morgan)
Liaison, Phys. Plant (Lyn E. Adams)
Life Safety Serv. (Bruce Macdonald)
Nuc. Reactor Prog. (Thomas C. Bray)

REACTOR SAFEGUARDS ADVISORY GROUP

Faculty:

	Term Expires
Jimmie J. Wortman, <i>Chair</i>	1987
K. L. Murty	1986
Hayne Palmour	1988

Ex officio:

Rad. Prot. Officer (D. William Morgan)

REGISTRATION, RECORDS AND CALENDAR

Faculty:

Charles F. Lytle, *Chair*
Robert C. Brisson
Joel V. Brothers
Halbert H. Carmichael
Edward D. Gurley, *Senate*
Thomas W. Joyce

Ex officio:

Registrar (James H. Bundy)
Rep., Lifelong Educ. (John F. Cudd)
Rep., Provost's Off. (Murray S. Downs)
5 Student Members

RESEARCH

Faculty:

Thomas LeVere, *Chair*
Klaus J. Bachmann
Robert E. Cook
Sherra E. Deihl-Nagle
Virginia A. Hiday
Russ Lea
Michael A. Littlejohn
Robin Moore
Leonard Pietrafesa
Edward P. Stahel II, *Senate*
Edith D. Sylla
Ching S. Teng
Elizabeth C. Theil
Paul A. Tucker

Ex officio:

Vice Chancellor, Research Admin.
(F. D. Hart)
Contracts & Grants Officer (Earl Pulliam)

RESEARCH REVIEW COMMITTEE ON INFECTIOUS DISEASES AND MICROORGANISMS

Faculty:

Herman Berkhoff
Lee Campbell
Leroy Coggins
James Lecce
Mike Levy
Richard Noble
Leo Parks

RESIDENCE LIFE

Faculty:

George B. Blum, *Chair*
Rachel K. Kinlaw
Rebecca Leonard
Carmine A. Prioli, *Senate*
John N. Wall
Tommy E. Wynn

Ex officio:

Rep., Residence Life
(Cynthia P. Bonner)
(William W. Guy)
5 Student Members

SAFETY COUNCIL

Faculty and Staff:

George H. Wahl, *Chair*
J. Carl Allred
Scott Bertness
Edward Clark
James W. Cook
Robert E. Cook
Terry E. Frye
Denis Jackson
Don Keener
Tommy Lassiter
Lee R. McDonald
Robert Metzger
Marie Ministero
Zeph Putnam
James Reviere
Rosina Rubes
William H. Simpson
Jerry Sprague
Richard Sykes

Ex officio:

Radiation Protection Off. (D. W. Morgan)
Assoc. Dir., Life Safety Services
(Bruce Macdonald)
2 Student Members

SCHOLARSHIPS AND STUDENT AID

Faculty:

Loren A. Ihnen, *Chair*
David M. Benson
George H. Blessis
Anne C. Clapp
Richard H. Cornell
Doris L. Laryea
Gloria J. Meares, *Senate*
Howard Petrea

Ex officio:

Fin. Aid Officer (Carl O. Eycke)
Assoc. Athl. Dir. (Frank Weedon)
Rep., Alumni Rel. (Bryce R. Younts)
Dir., Admissions (Anna Keller)
4 Student Members

STUDENT HEALTH

Faculty and Staff:

Richard A. Lauffer, *Chair*
James S. Brown
Judith A. Davis
Donald C. Levesque
Elizabeth Suval, *Senate*
James R. Troyer

Ex officio:

Coord., Stu. Health Serv. (Jerry W. Barker)
7 Student Members

SCHOOL/UNIT SEXUAL HARRASSMENT CONTACT PEOPLE

Faculty and Staff:

Robert Allen (*Human Resources*)
Jerry Barker (*Student Health Service*)
Lauren Brisky (*Finance and Business*)
Henry Brown (*Physical and Mathematical Sciences*)
Lawrence Clark (*Provost's Office*)
Brad Craig (*Agriculture and Life Sciences*)
Linda Fuller (*D. H. Hill Library*)
Molly Glander (*Counseling Center*)
Marie Green (*Veterinary Medicine*)
Mary Frances Hester (*University Extension*)
Bonnie Hine (*Computing Center*)
Peyton Hudson (*Textiles*)
Rae Kelly (*Human Resources*)
Pat McLean (*University Relations*)
Barbara Parramore (*Education*)
Frances Richardson (*Engineering*)
Frank Weedon (*Athletics*)
Elisabeth Wheeler (*Forest Resources*)
Susan Wilchins (*Design*)
Mary Williams (*Humanities & Social Sciences*)

TEACHING EFFECTIVENESS AND EVALUATION

Faculty:

George H. Wahl Jr., *Chair*
Michael A. Boles, *Senate*
John L. Crow
B. S. Gupta
Elaine Hunt
Richard A. King
Carolyn R. Miller
Thomas W. Reiland
Linda Sanders
Elisabeth A. Wheeler

Ex officio:

Assoc. Provost (Murray S. Downs)
Chairman, Academy of Outstanding Teachers (Virginia C. Downs)
Rep., Institutional Research (Brenda H. Rogers)
Pres., Grad. Stu. Assoc. (Joye Bennett)
6 Student Members

UNIVERSITY ACADEMIC COMPUTER PLANNING

Faculty and Staff:

Henry E. Schaffer, *Chair*
Sam Averitt
W. L. Ballenger
H. Leo Buckmaster
Leroy Coggins
Howard W. Etzel
G. David Garson
William L. Hafley
Thomas L. Honeycutt, *Senate*
Thomas Johnson
Siamak Khorram
Charles Leffler
Carl W. Malstrom
Benjamin T. McDaniel
Ralph McGregor
D. Scott McRae
John F. Monahan
Debra Stewart
John Tector
Robert K. White

UNIVERSITY DINING

Faculty:

Leonard W. Aurand, *Chair*
Jerry W. Barker

James L. DeWitt
Charles W. Harper, *Senate*
J. Paul Mueller
Lynn G. Turner

Ex officio:

Rep., Stu. Affairs (Henry Bowers)
Rep., University Dining (Arthur L. White)
5 Student Members

USE OF HUMAN SUBJECTS IN RESEARCH

Faculty:

Ian S. Longmuir, *Chair*
Claudia G. Allen
Maxine P. Atkinson
Mary K. Witges Bengtson
Edward V. Caruolo
Beverly A. Gilroy
Robert M. Hambourger
Donald H. Mershon
Thomas J. Monaco, *Senate*
William H. Sonner
T. Robert Mullinax, *Off-campus Rep.*

Term Expires

1989
1989
1986
1987
1989
1987
1986
1986
1986
1988

Ex officio:

Assoc. Dean, Research (Howard W. Etzel)
2 Student Members

FACULTY SENATE OFFICE

Sondra L. Kirsch, Chair
2319 Library, Box 7111
Phone: 2279

James E. Smallwood, Vice Chair
4700 Hillsborough St., Box 8401
Phone: 829-4223

Conrad H. Miller, Secretary
212 Kilgore, Box 7609
Phone: 3167

Rose M. Autry, Stenographer
2319 Library, Box 7111
Phone: 2279

FACULTY SENATE MEMBERSHIP 1985-1986

Name	Term Ends	School	Address	Phone
Abbate, Angelo	1986	Design	215-A Brooks—7701	2203
Barker, Kenneth R.	1986	SALS	840 Method Rd.—7616	3330
Boles, Michael A.	1987	Engineering	3184 Broughton—7910	3024
Camp, L. Raymond	1986	SHASS	210 Winston—8101	2450
Carter, Philip B.	1876	SVM	4700 Hillsborough— 8401	829-4256
Clark, Roger H.	1985	Design	310-F Brooks—7701	3051
Cortes, Dario A.	1986	SHASS	131 1911 Building—8106	2475
Coster, John K.	1987	Education	602-M Poe—7801	2234
Gurley, Edward D.	1985	Engineering	312 Mann—7908	2331
Hale, Francis J.	1986	Engineering	4222 Broughton—7910	2365
Harper, Charles W.	1986	Education	408-A Poe—7801	3221
Hassan, Awatif E.	1986	For. Resources	3024-C Biltmore—8002	2891
Hatch, Joyce	1987	PAMS	120 Daniels—8206	7027
High, Walter M.	1987	G. Constituency	1121 Broughton—7111	2603
Honeycutt, Thomas L.	1986	PAMS	122 Daniels—8206	7014
Hyman, David N.	1986	SHASS	306B Hillsborough—8109	2472
Johnson, Richard R.	1987	Engineering	4151 Broughton—7910	3241
Joyce, Thomas W.	1987	For. Resources	3104 Biltmore—8005	2888
Long, Raymond C.	1987	SALS	4310 Williams—7620	3216
Marlin, Joe A.	1986	PAMS	306 Harrelson—8205	3796
McGregor, Ralph	1986	Textiles	103 Clark—8302	2551
Meares, Gloria	1986	G. Constituency	200 Harris—7312	2423
Miller, Conrad H.	1985	SALS	212 Kilgore—7609	3167
Mock, Gary N.	1987	Textiles	15 Clark—8302	2551
Mock, Judieth E.	1986	SALS	F-1 Ricks—7605	2770
Monaco, Thomas J.	1987	SALS	158 Kilgore—7609	3133
Oeko, Jonathan K.	1987	SHASS	137 Harrelson—8108	2484
Prioli, Carmine A.	1987	SHASS	226 Tompkins—8105	3870
Reiland, Thomas W.	1987	PAMS	612-A Cox—8203	2531
Rohrback, Roger P.	1985	SALS	188 Weaver—7625	3101
Saxe, Raymond F.	1985	Engineering	1122 Burlington—7909	2302
Smallwood, James E.	1985	SVM	4700 Hillsborough St.— 8401	829-4223
Stahel, Edward P. II	1986	Engineering	308 Riddick—7905	2327
Suval, Elizabeth M.	1987	SHASS	318 1911 Building—8107	3114
Wilson, L. George	1986	SALS	228 Kilgore—7609	3283
<i>Ex officio:</i>				
Fearn, Robert M.	1986	<i>Immed. Past Chair</i>	6-B Patterson—8109	2605
Winstead, Nash N.		<i>Provost</i>	109 Holladay—7101	2195

FACULTY SENATE 1985-1986

STANDING COMMITTEES

ACADEMIC POLICY COMMITTEE

Honeycutt, Thomas L., *Chair*
Boles, Michael A.
Harper, Charles W.
Hassan, Awatif E.
Hatch, Joyce
McGregor, Ralph
Mock, Gary
Prioli, Carmine A.
Reiland, Thomas W.
Suval, Elizabeth M.
Contact in Univ.
Admin.—M. Downs.

COMMUNICATIONS COMMITTEE

Smallwood, James E., *Chair*
Carter, Philip B.
Hatch, Joyce
Hyman, David N.
Mock, Judieth E.
Monaco, Thomas J.
Saxe, Raymond F.
Stahel, Edward P.
Wilson, L. George
Contact in Univ. Admin.—
Admin.—L. Clark
Alumni Assoc.—B. Younts

CONSTITUTION AND BYLAWS COMMITTEE

Camp, L. Raymond, *Chair*
Boles, Michael A.
Harper, Charles
Hassan, Awatif E.
Johnson, Richard R.
Meares, Gloria
Miller, Conrad H.
Wilson, L. George
Contact in Univ. Admin.—
Clauston Jenkins, Murray S. Downs

ENVIRONMENTAL POLICY COMMITTEE

Rohrbach, Roger P., *Chair*
Abbate, Angelo
Carter, Philip B.
Gurley, Edward D.
High, Walter M.
Johnson, Richard R.
Long, Raymond C.
McGregor, Ralph
Mock, Judieth E.
Reiland, Thomas W.
Contact in Univ.
Admin.—L. Brisky

EXECUTIVE COMMITTEE

Kirsch, Sondra L., *Chair*
Camp, L. Raymond
Clark, Roger H.
Fearn, Robert M., *Immediate Past Chair*
Honeycutt, Thomas L.
Marlin, Joe A.
Miller, Conrad H.
Rohrbach, Roger P.
Smallwood, James E.
Agenda Comm.—S. L. Kirsch,
C. H. Miller & J. E. Smallwood

PERSONNEL POLICY COMMITTEE

Marlin, Joe A., *Chair*
Barker, Kenneth R.
Coster, John K.
Hale, Francis J.
High, Walter M.
Hyman, David N.
Joyce, Thomas W.
Monaco, Thomas J.
Ocko, Jonathan K.
Saxe, Raymond
Suval, Elizabeth M.
Contact in Univ. Admin.—
A. Miller & L. Clark

STUDENT AFFAIRS COMMITTEE

Clark, Roger H., *Chair*
Barker, Kenneth R.
Coster, John K.
Hale, Francis J.
Joyce, Thomas W.
Long, Raymond C.
Meares, Gloria
Ocko, Jonathan K.
Prioli, Carmine A.
Stahel, Edward P.
Contact in Univ. Admin.—
Tom Stafford

ADMINISTRATIVE COUNCIL

Chancellor, <i>Chairman</i>	Bruce R. Poulton
Vice Chancellor and Provost	Nash N. Winstead
Vice Chancellor for Development	John T. Kanipe Jr.
Vice Chancellor for Extension and Public Service	W. L. Turner
Vice Chancellor for Finance and Business	George Worsley
Vice Chancellor for Research	Franklin D. Hart
Vice Chancellor for Student Affairs	Thomas H. Stafford Jr.
Vice Provost and Dean, Graduate School	Jasper D. Memory
Dean, Agriculture and Life Sciences	J. E. Legates
Dean, Design	Claude E. McKinney
Dean, Education	Carl J. Dolce
Dean, Engineering	Larry K. Monteith
Dean, Forest Resources	Eric L. Ellwood
Dean, Humanities and Social Sciences	Robert O. Tilman
Dean, Physical and Mathematical Sciences	Garrett Briggs
Dean, Textiles	Dame Hamby
Dean, Veterinary Medicine	Terrence M. Curtin
Director, Athletics	Willis R. Casey
Director, University Relations	Albert B. Lanier Jr.
Coordinator, International Programs	J. Lawrence Apple
University Counsel	Clauston L. Jenkins
Secretary of the University	William H. Simpson
Chair, Faculty Senate	Sondra L. Kirsch

BUILDING LIAISON PHYSICAL PLANT DIVISION

Building/Area	Building Liaison	Energy Conservation Liaison
Agri. and Life Sciences Research Annex	D. F. Bateman	D. F. Bateman
Alumni Building		
Alumni Relations	Joyce Marshall	Joyce Marshall
Purchasing	Katherine Suggs	Katherine Suggs
Armory Shops Building	Ed Norris	John Clapp
Athletic Areas (Outside)	Richard Sykes	Richard Sykes
Biltmore Hall	Nancy Roberts	Nancy Roberts
Robertson Wing	Nancy Roberts	Nancy Roberts
Biological Sciences Headhouse and Greenhouse		
	W. L. Klarman	W. L. Klarman
	Ray Wilder (Alt.)	Ray Wilder (Alt.)
	J. A. Daughtry (Alt.)	J. A. Daughtry (Alt.)
Bostian Hall	C. F. Lytle	C. F. Lytle
Bragaw Computer Terminal Room—Rm 147	Carl Allred	Carl Allred
Brooks Hall	Winifred Hodge	Don Barnes
110 Brooks Ave. (Turner House)	John Dodson	John Dodson
Broughton Hall		
Computer Terminal Room (Rm. 1404)	Carl Allred	Carl Allred
Engineering (Including Diesel)	George O. Batton	George O. Batton
Bureau of Mines	J. S. Risley	J. S. Risley
	Leslie B. Sims (Alt.)	Leslie B. Sims (Alt.)
Burlington Nuclear Laboratories		
Computer Science (Rms. 1204 & 1205)	N. F. Williamson	N. F. Williamson
	Leslie B. Sims (Alt.)	Leslie B. Sims (Alt.)
Computer Terminal Room (Rm. 1139)	Carl Allred	Carl Allred
Engineering Research	Michael J. Paisley	Michael J. Paisley
Nuclear Engineering (Includes Marine Sciences)	Garry Miller	Garry Miller
Carmichael Gymnasium	Jack Shannon	Jack Shannon
	Elaine Harris (Alt.)	Elaine Harris (Alt.)
Carter-Finley Stadium	Richard Sykes	Richard Sykes
Case Athletics Center	Bob Robinson	Bob Robinson
Cates Ave. Steam Plant	Carl Fulp	John Clapp
Central Stores	Roger Duckett	Roger Duckett
Chancellor's Residence	Pat Hannon	John Clapp
Clark Infirmary	Jerry Barker	Jerry Barker
Cotton/Soybean Lab (Ligon Rd.)	R. F. Wilson	R. F. Wilson
Cox Hall		
Dean's Area	Leslie B. Sims	Leslie B. Sims
Physics	Tom Hill	Tom Hill
	Leslie B. Sims (Alt.)	Leslie B. Sims (Alt.)
Statistics	Bill J. Stines	Bill J. Stines
	Leslie B. Sims (Alt.)	Leslie B. Sims (Alt.)
Cultural Center	Larry Campbell	Larry Campbell
Dabney Hall		
Biochemistry (Rms. 308, 316, and Cold Room)	Samuel Tove	Samuel Tove
	Pat Munn (Alt.)	Pat Munn (Alt.)
Chemistry	Curtis G. Harris	Curtis G. Harris
	Kenneth W. Hanck	Kenneth W. Hanck
	Leslie B. Sims (Alt.)	Leslie B. Sims (Alt.)
Computer Terminal Room (Rm. 120)	Carl Allred	Carl Allred
Placement Center	Walter B. Jones	Walter B. Jones
Daniels Hall		
Computer Graphics Center	Paul Karlak	Paul Karlak
Computer Science	N. F. Williamson	N. F. Williamson
	Leslie B. Sims (Alt.)	Leslie B. Sims (Alt.)
Computer Terminal Room (Rm. 118)	Carl Allred	Carl Allred
Electrical Engineering	A. J. Goetze	A. J. Goetze
Microelectronics Center	Richard Kuehn	Richard Kuehn
Physics	W. O. Doggett	W. O. Doggett
	Leslie B. Sims (Alt.)	Leslie B. Sims (Alt.)

Building/Area	Building Liaison	Energy Conservation Liaison
Research Administration	Vita M. Dick	Vita M. Dick
David Clark Laboratories		
Textiles	L. T. Lassiter	L. T. Lassiter
	C. D. Livengood (Alt.)	
Radiation Protection	D. W. Morgan	D. W. Morgan
Dearstyne Avian Research Center		
Physiology Building	J. E. Marion	J. E. Marion
and Nutrition Building	Larry Rozier (Alt.)	Larry Rozier (Alt.)
D. H. Hill Library	Donald S. Keener	Donald S. Keener
Erdahl-Cloyd Wing		
Food Services Area	Art White	Art White
Library	Donald S. Keener	Donald S. Keener
North Campus Bookstore	Jim Garrison	Jim Garrison
Student Union Area	Henry Bowers	Henry Bowers
	Lee McDonald	Lee McDonald
	Herbert Strickland	Herbert Strickland
Dining Hall	Zeph Putman	Zeph Putman
Field House (Riddick)	Terry Abney	Terry Abney
Forest Resources Annex	Bob Maimone	Bob Maimone
Fraternity Housing	Robert S. Bryan Jr.	Robert S. Bryan Jr.
Gardner Hall		
Botany	E. D. Seneca	E. D. Seneca
Entomology	R. L. Hines	R. L. Hines
Genetics	C. L. Carroll	C. L. Carroll
Microbiology	L. W. Parks	L. W. Parks
Plant Pathology	Ray Wilder	Ray Wilder
	W. L. Klarman (Alt.)	W. L. Klarman (Alt.)
	J. A. Daughtry (Alt.)	J. A. Daughtry (Alt.)
Zoology	J. G. Vandenberg	J. G. Vandenberg
Grinnells Lab		
Animal Science	E. V. Caruolo	E. V. Caruolo
Entomology	G. C. Rock	G. C. Rock
Harrelson Hall		
Mathematics	Donald Hansen	Donald Hansen
	Leslie B. Sims (Alt.)	Leslie B. Sims (Alt.)
University Studies	Mary Morgan	Mary Morgan
Harris Hall	G. G. Hawkins	G. G. Hawkins
Hillsborough Building		
Administrative Computing Services	H. Leo Buckmaster	H. Leo Buckmaster
Computing Center	Carl Allred	Carl Allred
Economics	J. E. Easley	J. E. Easley
3710 Hillsborough		
(Universal Equip. Bldg.)	T. J. Sheets	T. J. Sheets
Hodges Wood Products Lab	Nancy Roberts	Nancy Roberts
Holladay Hall	Patrice Hill	Patrice Hill
Horticulture Headhouses & Greenhouses	P. N. Lineberger	P. N. Lineberger
	W. H. Johnson (Alt.)	W. H. Johnson (Alt.)
Information Booth	Carol Tharrington	Carol Tharrington
Japan Center	John Sylvester	John Sylvester
Kilgore Hall	A. A. De Hertogh	A. A. De Hertogh
E. S. King Village	Eli Panee	Eli Panee
Landscape Services	Frank Bynum	John Clapp
Laundry	Wilton Gower	Wilton Gower
Leazar Hall		
Finance & Business	Mary Wallace	Mary Wallace
Computer Science	Harry Kuhman	Harry Kuhman
	Leslie B. Sims (Alt.)	Leslie B. Sims (Alt.)
Dairy Records	K. R. Butcher	K. R. Butcher
Physical Plant	George Lynch	John Clapp
School of Design	Winifred Hodge	Don Barnes
Link	Joyce Barbour	Joyce Barbour
Mann Hall		
Civil Engineering	P. H. McDonald	P. H. McDonald
Computer Terminal Room (Rm. 222)	Carl Allred	Carl Allred

Building/Area	Building Liaison	Energy Conservation Liaison
McKimmon Center	Denis Jackson	Denis Jackson
MEAS Building	Paul Blankinship	Paul Blankinship
Method Road Greenhouse Complex	W. H. Johnson	W. H. Johnson
	Neil T. Robertson (Alt.)	Neil T. Robertson (Alt.)
Morris Building	Page Billingsley	John Clapp
Motor Pool	Randy Bowen	John Clapp
Mycotoxin Lab	J. E. Marion	J. E. Marion
	Larry Rozier (Alt.)	
Nelson	L. T. Lassiter	L. T. Lassiter
	S. P. Hersh (Alt.)	
1911 Building		
Agriculture	W. B. Clifford	W. B. Clifford
Humanities & Social Sciences	Nelson Reid	Nelson Reid
Sea Grant Program	Ronald G. Hodson	Ronald G. Hodson
219 Oberlin Rd.	Betty Dunn	Betty Dunn
Page Hall		
Engineering	Jemma S. Rayfield	Jemma S. Rayfield
Water Resources	Linda Lambert	Linda Lambert
Park Shops Building		
Industrial Engineering	Darrell B. Rice	Darrell B. Rice
Physical Plant	Berry Dunston	John Clapp
Parking Areas	Sam Penny	Sam Penny
Patterson Hall	E. W. Glazener	E. W. Glazener
Peele Hall	Ronald Butler	Ronald Butler
Phytotron	R. J. Downs	R. J. Downs
Poe Hall	Robert Williams	Robert Williams
Polk Hall		
Animal Science	Jackie S. Riggsbee	Jackie S. Riggsbee
Biochemistry	Samuel B. Tove	Samuel B. Tove
	Pat Munn (Alt.)	
Price Music Center	Perry Watson	Perry Watson
Primrose Hall	John Brooks	John Brooks
Radiation Areas	D. W. Morgan	D. W. Morgan
Reclamation Center	Randy Bowen	John Clapp
Residence Halls	William Guy	William Guy
Reynolds Coliseum		
Athletics	Dick Farrell	Dick Farrell
ROTC (Air Force)	Col. Cleveland Simpson	Col. Cleveland Simpson
ROTC (Army)	Col. Martin Anderson	Col. Martin Anderson
Ricks Hall	David Jenkins	David Jenkins
Riddick Lab		
Material Engineering		
(Includes Annex)	Michael J. Paisley	Michael J. Paisley
Industrial Engineering	John Ekwall	John Ekwall
Chemical Engineering	Barry King	Barry King
Riddick Stadium Stands		
Central Stores	Roger Duckett	Roger Duckett
Personnel	Cornelia Moore	Cornelia Moore
Physical Plant	Page Billingsley	John Clapp
Schaub Hall	John Miles	John Miles
	V. A. Jones (Alt.)	V. A. Jones (Alt.)
Scott Hall	J. E. Marion	J. E. Marion
	Larry Rozier (Alt.)	
Small Animal Facility	Nathaniel Smith	Nathaniel Smith
Snackbar and Vending Machine Areas	Walt Barkhouse	Walt Barkhouse
Sorority Housing	Robert S. Bryan Jr.	Robert S. Bryan Jr.
Students Supply Stores (Main Store)	Jim Garrison	Jim Garrison
Frank Thompson		
Craft Shop	Conrad Weiser	Conrad Weiser
Military Supply	Linda Evans	Linda Evans
All other areas	John Andrews	John Andrews
Tompkins Hall	Virginia Aldridge	Virginia Aldridge
Tucker Resid. Hall		
Computer Terminal Rm.	Carl Allred	Carl Allred

Building/Area	Building Liaison	Energy Conservation Liaison
TV Station	Hazel "Mac" Maddrey	Hazel "Mac" Maddrey
University Graphics	D. Douglas Bullock (Alt.)*	D. Douglas Bullock (Alt.)*
University Student Center	Scott G. Bertness	Scott G. Bertness
Food Service	Art White	Art White
Student Center	Henry Bowers	Henry Bowers
	Lee R. McDonald	Lee R. McDonald
	Herbert Strickland	Herbert Strickland
Student Publications	Evelyn Reiman	Evelyn Reiman
Varsity Drive Facility (Entomology Extension)	P. S. Southern	P. S. Southern
Veterinary Medicine School	Daniel J. Moncol	Daniel J. Moncol
Weaver Laboratories	Robert G. Gaines	Robert G. Gaines
	F. G. Hassler (Alt.)	
Weisiger-Brown	Richard Sykes	Richard Sykes
Weed Control Lab	A. D. Worsham	A. D. Worsham
Williams Hall		
Crop Science	R. C. Long	R. C. Long
	Billy Caldwell (Alt.)	Billy Caldwell (Alt.)
Soil Science	R. H. Miller	R. H. Miller
Winston Hall		
Humanities & Social Sciences	Ann Rives	Ann Rives
Telephone Exchange	Olive Stone	Olive Stone
Withers Hall		
Chemistry	Jimmy Stephenson	Jimmy Stephenson
	Leslie B. Sims (Alt.)	Leslie B. Sims (Alt.)
Marine, Earth and Atmospheric Sciences	Henry Brown	Henry Brown
	Leslie B. Sims (Alt.)	Leslie B. Sims (Alt.)
Yarborough Dr. Steam Plant	Carl Fulp	John Clapp

* In Chapel Hill Office

ACADEMIC CALENDAR NORTH CAROLINA STATE UNIVERSITY

1985-1986

FALL SEMESTER

Friday, August 23	Registration/Change Day (Late Registration, Drop/Add)
Monday, August 26	First day of classes
Monday, September 2	Holiday
Tuesday, September 3	Last day to add a course without permission of instructor
Monday, September 9	Last day to add a course; last day to withdraw or drop a course with a refund; last day for undergraduate students to drop below 12 hours
Monday, September 23	Last day to withdraw or drop a course at the 400 level or below without a grade
Friday, October 4	Mid-semester reports due
Friday, October 11	Fall vacation begins at 10 p.m.
Wednesday, October 16	Classes resume at 7:50 a.m.
Friday, October 25	Last day to withdraw or drop a course at the 500 or 600 level without a grade; last day for all students to change to credit only
Wednesday, November 27	Thanksgiving vacation begins at 1 p.m.
Monday, December 2	Classes resume at 7:50 a.m.
Friday, December 6	Last day of classes
Monday, December 9—	Final examinations
Tuesday, December 17	

SPRING SEMESTER

Monday, January 7	Registration Day/Change Day (Late Registration, Drop/Add)
Thursday, January 9	First day of classes
Wednesday, January 15	Last day to add a course without permission of instructor
Wednesday, January 22	Last day to add a course; last day to withdraw or drop a course with a refund; last day for undergraduate students to drop below 12 hours
Wednesday, February 5	Last day to withdraw or drop a course at the 400 level or below without a grade
Wednesday, February 19	Mid-semester reports due
Friday, February 28	Spring vacation begins at 10 p.m.
Monday, March 10	Classes resume at 7:50 a.m.
Friday, March 14	Last day to withdraw or drop a course at the 500 or 600 level without a grade; last day for all students to change to credit only
Monday, March 31	Holiday
Friday, April 25	Last day of classes
Monday, April 28—	Final examinations
Tuesday, May 6	
Saturday, May 10	Commencement

FIRST SUMMER SESSION

Monday, May 19	Registration Day/Change Day
Tuesday, May 20	First day of classes
Wednesday, May 21	Last day to add a course without permission of instructor
Monday, May 26	Last day to add a course; last day to withdraw or drop a course with a refund
Friday, May 30	Last day to withdraw or drop a course at the 400 level or below without a grade
Friday, June 6	Last day to withdraw or drop a course at the 500 level without a grade
Monday, June 23	Last day of classes
Tuesday, June 24—	Final examinations
Wednesday, June 25	

SECOND SUMMER SESSION

Monday, June 30	Registration Day/Change Day
Tuesday, July 1	First day of classes
Wednesday, July 2	Last day to add a course without permission of instructor
Friday, July 4	Holiday
Monday, July 7	Last day to add a course; last day to withdraw or drop a course with a refund
Friday, July 11	Last day to withdraw or drop a course at the 400 level or below without a grade
Friday, July 18	Last day to withdraw or drop a course at the 500 level without a grade
Tuesday, August 5	Last day of classes
Wednesday, August 6—	Final examinations
Thursday, August 7	



NORTH CAROLINA STATE UNIVERSITY

Access Key

- can be entered by an individual in a wheelchair with no assistance
- can be entered by an individual in a wheelchair with minimum assistance
- N, S, E, W.—indicates side of building with accessible entrance
- passenger elevator
- freight elevator
- T accessible toilet

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Access Key

- can be entered by an individual in a wheelchair with no assistance
- can be entered by an individual in a wheelchair with minimum assistance

N, S, E, W,—indicates side of building with accessible entrance.

— passenger elevator.

■ freight elevator

T accessible toilet

ACCESS	NO.	BUILDING NAME
	1	Alexander Residence
	2	Alumni Memorial Bldg.
	3	Bagwell Residence Hall
	4	Becton Residence Hall
	5	Berry Residence Hall
	6	Biltmore Hall
	7	Bowen Residence Hall
	8	Bragaw Residence Hall
● N, C, T	9	Brooks Hall
● N, C	10	Brooks Hall Addition
● N, C, T	11	Broughton Hall
● N, C	12	Burlington Engineering
● T	13	Bureau of Mines
	14	Carmichael Gymnasium
	15	Carroll Residence Hall
● N	16	Casa Athletics Center
	17	Central Stores
	18	Chancellor's Residence

FREQUENTLY CALLED NUMBERS

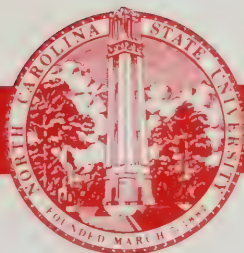
This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.



97th Annual
Commencement
North Carolina State University

Saturday, May 10
Nineteen Hundred and Eighty-Six
Degrees Awarded 1985-86

CORRECTED COPY



DEGREES CONFERRED



A corrected issue of undergraduate and graduate degrees including degrees awarded June 27, 1985, August 8, 1985, December 17, 1985, and May 10, 1986.

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Musical Program

EXERCISES OF GRADUATION

May 10, 1986

Commencement Band Concert: 8:30 a.m.

William Neal Reynolds Coliseum

Sine Nomine Vaughan Williams

Festive Overture Shostakovich

Incantation & Dance Chance

Chester Schuman

America the Beautiful Ward-Dragon

PROCESSIONAL: 9:00 a.m.

March Processional Grundman

RECESSIONAL:

University Grand March Goldman

NORTH CAROLINA STATE UNIVERSITY COMMENCEMENT BAND

Dr. Frank M. Hammond, Conductor

The Alma Mater

Words by:

ALVIN M. FOUNTAIN, '23

Music by:

BONNIE F. NORRIS, JR., '23

Where the winds of Dixie softly blow
o'er the fields of Caroline,

There stands ever cherished N. C. State,
as thy honored shrine.

So lift your voices; Loudly sing
from hill to oceanside!

Our hearts ever hold you, N. C. State
in the folds of our love and pride.

Exercises of Graduation

William Neal Reynolds Coliseum

Bruce R. Poulton, Chancellor
Presiding

May 10, 1986

PROCESSIONAL, 9:00 a.m. Frank M. Hammond
Conductor, North Carolina State University Commencement Band

The Audience is requested to remain seated during
the Processional.

WELCOME Chancellor Bruce R. Poulton

INVOCATION The Reverend Starke S. Dillard, Jr.
Assistant to the Rector
Christ Episcopal Church
Raleigh, North Carolina

NATIONAL ANTHEM Commencement Band

INTRODUCTIONS Chancellor Poulton

ADDRESS Dr. William C. Friday
President Emeritus
The University of North Carolina

CONFERRING OF HONORARY DEGREE Chancellor Poulton

CONFERRING OF DEGREES Chancellor Poulton
Candidates for baccalaureate degrees presented by
Deans of Schools, Candidates for Doctor of Veterinary
Medicine presented by Dean of Veterinary School,
Candidates for other advanced degrees presented by
Associate Dean of Graduate School.

ADDRESS TO FELLOW GRADUATES A. Jay Everette
Class of 1986

RECOGNITIONS Chancellor Poulton

VALEDICTORIANS—CLASS OF 1986

Robert Chancy Blohm
Alan Hedgecock Clark
Catherine Mason Gordon
Cynthia Lynn Hixon

Eva Carol Pickler
Kathleen McKinney Rau
Christopher J. Riley
Melanie Carol Trull

ALMA MATER Milton C. Bliss
Assistant Director of Music

The Audience is invited to stand and join in the singing
of the Alma Mater.

RECESSIONAL

The Audience is requested to remain seated until the
Recessional music is completed.

Commencement Ushers

Air Force ROTC Ushers

Terry Hunter
Robert L. Jones
Donald P. Duckett, Jr.
Mike Coon
William J. Compton
Christopher J. Roach
Todd Blocker
Leonard P. Harrison
Christopher L. Bright
Roy T. Ellis
William M. Tart
Robert K. P. Boone

Army ROTC Ushers

Brian D. Hinkle
Terryne F. Murphy
Douglas E. Hefner
Jonathan K. Grooms
Christopher G. Cross
Jennifer L. Brown
James F. Jones
Robert E. Hester
Robert C. Alridge, III
Jerry V. Midyette
Gartha Ingram, III
Robert A. Boyette

Commencement Marshals

Robert D. Barnes
Steven B. Caldwell
Beth Gray
Belinda Marie Haselrig
Karla R. Hauersperger
Norma Jane Holland
Steven P. Isenhour

Sheri L. Jackson
Jackie Jeter
James F. Jones
Thomas J. Monaco, Jr.
Amy F. Moormann
John M. Nunnally
Timothy Scronce

Faculty Retirements 1985-86

Barnes, Donald W., Jr., School of Design, Retired December 31, 1985
Behlow, Robert F., School of Agriculture and Life Sciences, will retire June 30, 1986
Brendenberg, Paul A., School of Humanities and Social Sciences, will retire May 15, 1986
Garcia, Betram H., Jr., School of Engineering, retired December 31, 1985
Garmon, William M., School of Agriculture and Life Sciences, retired December 31, 1985
Goetze, Alfred J., School of Engineering, will retire May 15, 1986
Goode, Lemuel, School of Agriculture and Life Sciences, will retire June 30, 1986
Grosch, Daniel S., School of Agriculture and Life Sciences, retired September 30, 1985
Harwood, Dewey G., School of Agriculture and Life Sciences, retired March 31, 1986
Highfill, William L., School of Humanities and Social Sciences, will retire May 15, 1986
Hughes, George Roscoe, School of Agriculture and Life Sciences, will retire June 30, 1986
Leatherwood, James Murray, School of Agriculture and Life Sciences, will retire June 30, 1986
Legates, James W., School of Agriculture and Life Sciences, will retire June 30, 1986
McNeill, John J., School of Agriculture and Life Sciences, retired December 31, 1985
Myers, Richard M., School of Agriculture and Life Sciences, retired December 31, 1985
Nichols, Thomas Everett, Jr., School of Humanities and Social Sciences, will retire June 30, 1986
Phillips, Lyle L., School of Agriculture and Life Sciences, retired December 31, 1985
Saucier, Walter Joseph, School of Physical and Mathematical Sciences, retired December 31, 1985
Smith, William E., School of Textiles, retired December 31, 1985
Sox, Jason L., School of Physical and Mathematical Sciences, will retire May 15, 1986
Toussaint, William Douglas, School of Humanities and Social Sciences, will retire June 30, 1986
Whaley, Wilson M., School of Textiles, retired September 30, 1985
Whitfield, John K., School of Engineering, retired December 31, 1985

Social Hour and Distribution of Diplomas

School and Department Locations

School of Agriculture and Life Sciences—11:15 a.m.

Adult Education Room 1C-D, McKimmon Center,
Western Boulevard

Agricultural Business Management and Agricultural

Economics Main Floor, Reynolds Coliseum

Agronomy, Crop Science and Soil Science 2215 and 2223 Williams Hall

Animal Science Room 2, McKimmon Center

Biochemistry 3712 Bostian Hall

Biological and Agricultural Engineering Weaver Laboratories Pavilion

Biological Sciences 3712 Bostian Hall

Biological Sciences Major

Botany

Ecology

Entomology

Genetics

Microbiology

Nutrition

Pest Management

Physiology

Plant Pathology

Toxicology

Conservation 2722 Bostian Hall and adjacent breezeway or
2215 and 2223 William Hall

Food Science 105 Schaub-Food Science Building

Horticultural Science 121, 125 and 159 Kilgore Hall

Individualized Study Program Location of Major Faculty Adviser

Poultry Science Baptist Student Center, 2702 Hillsborough Street

Applied Sociology 218 Withers Hall

Zoology 2722 Bostian Hall and adjacent breezeway

Fisheries and Marine Biology

Fisheries and Wildlife Science

Medical Technology

Wildlife Biology

Zoology Majors

School of Design—11:15 a.m. Stewart Theatre
12:30 p.m. Reception Brooks Hall

School of Education—11:15 a.m.

Administration and Supervision 220 Poe Hall

Adult and Community College Education 1C and 1D McKimmon Center

Counselor Education 532 Poe Hall

Curriculum and Instruction, Special Education,
and Middle Grades Education 412 Poe Hall

Education General Studies 220 Poe Hall

Mathematics and Science Education—

11:15 a.m. Reception 320 Poe Hall

12:00 noon Diploma Presentation 216 Poe Hall

Occupational Education; Agricultural Education; Health
 Occupations Education; Industrial Arts Education;
 Industrial and Technical Education; and
 Occupational Education Rooms 7 and 8 McKimmon Center
 Psychology 216 Poe Hall

School of Engineering—11:15 a.m.

Biological and Agricultural Engineering Weaver Laboratories Pavilion
 Chemical Engineering Thompson Theater
 Civil Engineering Lobby of Mann Hall
 Electrical and Computer
 Engineering (11:30) Hayes Barton Baptist Church
 1800 Glenwood Avenue
 Engineering Operations 242 Riddick Laboratories
 Furniture Manufacturing and Management Ballroom, Faculty Club
 Industrial Engineering Ballroom, Faculty Club
 Mechanical and Aerospace
 Engineering University Student Center Ballroom
 Materials Engineering University Room, Faculty Club
 Nuclear Engineering North Portico, Burlington
 Engineering Laboratories

School of Forest Resources—11:15 a.m. Area 1A and B,
 McKimmon Center

School of Humanities and Social Sciences—11:15 a.m.

Accounting, Business Management,
 and Economics Main Floor, Reynolds Coliseum
 History 100 Harrelson
 Multi-Disciplinary Studies Program
 English, Foreign Languages and Literatures,
 Philosophy and Religion West Raleigh Presbyterian Church,
 27 Horne Street
 Political Science Link Building Patio
 (Rain: Link Building Lobby)
 Sociology 218 Withers Hall
 Speech-Communication G-107 Link Building

School of Physical and Mathematical Sciences—11:15 a.m.

Chemistry; Marine, Earth and Atmospheric Sciences;
 Mathematics; Physics; and Statistics 124 Dabney
 Computer Science 222 Dabney

School of Textiles—11:15 a.m. Forest Hills Baptist Church
 3110 Clark Avenue

ROTC COMMISSIONING CEREMONY

MAJOR HARRY M. DUBOSE, US ARMY
Presiding

Stewart Theatre
May 10, 1986

PROCESSIONAL MARCH, 2:00 p.m. Dr. Frank M. Hammond
Conductor, North Carolina State University Commencement Band
The audience is requested to remain seated until Processional music is completed

NATIONAL ANTHEM

INVOCATION Captain Patrick D. Neal
Chaplain, USA Reserve
Garner, NC

INTRODUCTIONS Dr. Bruce R. Poulton
Chancellor, North Carolina State University

ADDRESS Lieutenant General (Retired) Walter F. Ulmer Jr.
United States Army

ADMINISTRATATION OF OATH
OF OFFICE Lieutenant Colonel(P) Martin S. Anderson
Professor of Military Science
Colonel Cleveland Simpson
Professor of Aerospace Studies

PRESENTATION OF CERTIFICATES Dr. Bruce R. Poulton

BENEDICTION Captain Patrick D. Neal

RECESSIONAL

The audience is requested to remain seated until the Recessional music is completed.

Academic Costume

Academic gowns represent a tradition handed down from the universities of the Middle Ages. These institutions were founded by the Church; the students, being clerics, were obliged to wear the prescribed gowns at all times. Round caps later became square mortarboards; the hoods, originally cowls attached to the gowns, could be slipped over the head for warmth.

Many European universities have distinctive caps and gowns which are different from those commonly used in this country. Some of the gowns are of bright colors and some are embellished with fur. A number of these may be noted in the procession.

The usual color for academic gowns in the United States is black. The bachelor's gown is worn closed, the master's and doctor's may be worn open or closed. The shape of the sleeve is the distinguishing mark of the gown: bachelor—long pointed sleeves; master—oblong, square cut in the back with an arc cut away in front; doctor—bell shaped.

Caps are black. The tassels for the Ph.D. degree are gold and those for other graduate and professional degrees may be of the color corresponding to the trimmings on the hoods.

Of all the components of the academic costume, the hood bears the heaviest symbolic burden. The hood must make clear the level of the degree, the faculty in which it was given, and the institution which awarded it. The level of the degree is shown by the size of the hood, the width of the velvet trimming, and in the case of doctors, by the shape. The bachelor's, master's, and doctor's hoods are three feet, three and one-half feet, and four feet long, respectively. The velvet trimming in the same order is two, three, and five inches and extends all around the hood on the exposed edge. This same trimming identifies the faculty in which the degree was awarded. For each faculty there is a corresponding color; so a glance at the trimming is all that is needed to identify the faculty. A *partial* list of the colors follows: Agriculture, maize; Architecture and Art, brown; Science, golden yellow; Economics, copper; Education, light blue; Engineering, orange; Forestry, russet; Physical Education, sage green; Religion, scarlet; Speech, silver gray; Veterinary Medicine, gray; Textiles, wine red. The following faculties have the same color—dark blue: Anthropology, History, Languages, Literature, Philosophy, Political science, Sociology.

Academic Honors

Honors participants benefit from a more individualized and rigorous approach to their desired degree through special classes, seminars and individual research.

Undergraduate degree honor designations are:

Cum Laude—for GPA 3.250 through 3.499

Magna Cum Laude—for GPA 3.500 through 3.749

Summa Cum Laude—for GPA 3.750 and above.

UNDERGRADUATE DEGREES

School of Agriculture and Life Sciences



BACHELOR OF SCIENCE IN BIOLOGICAL AND AGRICULTURAL ENGINEERING

Jointly administered by the School of Agriculture and Life Sciences and the School of Engineering. See page 18 under the School of Engineering for a listing of the graduate seniors in the jointly administered program.

BACHELOR OF SCIENCE IN CONSERVATION

Jointly administered by the School of Agriculture and Life Sciences and the School of Forest Resources.

Degrees Conferred December 17, 1985

*Stuart Bernard Black	Burnsville
Phyllis Dawn Hockett	Greensboro
Edmond Scott Stone	Weldon

Degrees Conferred May 10, 1986

**Ron Hanson Lilley	Washington
James Raeford Massey, Jr.	Princeton

BACHELOR OF SCIENCE IN AGRICULTURAL BUSINESS MANAGEMENT

Degrees Conferred December 17, 1985

William Ray Carroll, Jr.	Mullins, SC
Connie Ann Cummings	Rocky Mount
†David Theodore Goodson	Mount Olive
Edward Craig Sasser	Hallsboro
Andrea Lee Wall	Marion

Degrees Conferred May 10, 1986

Thomas Keith Adcox	Battleboro
†Phillip Lee Brooks	Pittsboro
†Mark Durant Crisco	Albemarle

†Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

Mack Lee Gay, III	Rocky Mount
Michael Elliott Keel	Whitakers
Paul Benson Kelley, Jr.	Fayetteville
Stevie Trent Locklear	Clinton

BACHELOR OF SCIENCE IN AGRICULTURAL ECONOMICS

Degree Conferred June 27, 1985

Christopher Veldey Mier	Ponte Vedra Beach, FL
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Degree Conferred August 8, 1985

Walter Kinsey Speight	Tarboro
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Degrees Conferred December 17, 1985

Paul Wayne Ashworth	Danville, VA
Timothy Andrew Weaver	Vale

Degrees Conferred May 10, 1986

Gilberto Alcides Alvarez	David, Panama
David Stephen Chesnick	Raleigh
Frank Wilson Coble, Jr.	Mount Ulla
Charles Andrew Daughtry	Princeton
Sandra Boyd Grey	Concord
John Norwood Hickman	Horntown, VA
Evelyn Kay Lemly	Fleetwood
Philip Cooper McAuley	Statesville

BACHELOR OF SCIENCE IN AGRONOMY

Degree Conferred June 27, 1985

Jose Maria Obregon	Bogota, Colombia
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Degrees Conferred December 17, 1985

Jamie Jean Bronson	Kinsman, OH
*David Lindley Jordan	Edenton
**Ron Hanson Lilley	Washington
David Todd McManus	Midland
Teresa Jane Rogister	Tarboro
*Eric Norman Thompson	Winston-Salem

Degrees Conferred May 10, 1986

Robert Spence Bass	Nashville
*Robert Joseph Bowers, Jr.	Sanford
Atwell Craig Cook	Hiddenite
**Raymond Pearson Garner, Jr.	Roanoke Rapids
Kenneth Craig Haire	Fuquay-Varina
Stevie Grey Harrell	Jackson
Carl Richard Johnson, III	Charlotte
Johnston Abel Kale	Chilanga, Zambia
*Daniel Carson Knott	Roanoke Rapids
Lisa Anne Leete	Warrenton
Ann Stack McMillan	Laurinburg
Stephen Andrew Oglesby	Oak City
Deloris Renee Riddle	Goldsboro
Charles Lawrence Salmon	Greensboro

†Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

George Ernest Smith	Bladenboro
H**Glenn Ralph Stocks	Enfield
James Haverson Ward	Battleboro
Michael Glenn Webb	Gatesville
Paula Denise Woodall	Smithfield

BACHELOR OF SCIENCE IN ANIMAL SCIENCE

Degrees Conferred June 27, 1985

Sherry Lynn Bowen	Raleigh
Katherine Anne Bugg	Durham
Sharron Lee Davidson	Concord
Sherry Faye Faust	Cleveland
H**Carole Ann Thomas	Wilson

Degree Conferred August 8, 1985

Gwen Gibson Eckerson	Lumberton
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Degrees Conferred December 17, 1985

Susan Frances Ammons	Charlotte
Carlton Scott Beauchamp	Winston-Salem
Denise Lynn Brigham	Goldsboro
Terri Alexis Bryant	Rocky Mount
Jeffrey Kenneth Canter	Wilkesboro
Paula Jean Cochran	Charlotte
Michael Andrew Dixon	Hurdle Mills
Sandra Dee Green	Statesville
Susan Kaye Hall	Sanford
Teresa Anne Harris	Snow Hill
Faye Marie Henderson	Durham
Elizabeth Elaine Jordan	Zebulon
Len Edward Murray	Pembroke
Lorraine Leigh Overcash	Monroe
Warren Craig Perry	Gatesville
Alisa Carol Riggins	Gibsonville
Sara Elizabeth Short	Raleigh
H**Susan Arnold West	Rocky Mount
Jamie Lamar Williams	Angier

Degrees Conferred May 10, 1986

Jane Elizabeth Armour	Raleigh
Jessica Marie Baker	Monroe
†Lisa Diane Baker	Raleigh
***Steve Weldon Breeding	Conway, AR
Donna Kim Bridges	Polkville
†Phillip Lee Brooks	Pittsboro
*Mary Genia Buck	Gates
Steven Brooks Cabell	Tarboro
Ashley Ellen Carriker	Pfafftown
Jennifer Cheek	Chapel Hill
*Margaret Paige Collier	Statesville
**Glenn Dale Detweiler	Hickory
†Mary Beth Farley	Roanoke Rapids
H*Joseph Thomas French	Reidsville
Margaret Sarah Gettys	Hollis
†Rebecca Ann Gore	Clarendon

Keith Dale Hartman	Walnut Cove
Kimberly Yvette Harward	Concord
Scott David Heintzelman	Charlotte
John Mark Helton	Mount Airy
H*Susan Williams Helton	Morganton
Edward Wade Humphrey	Buies Creek
Patricia Ann Jenkins	Durham
**Joel Leslie Johnson	Morrisville
Lori Ann Johnson	Greensboro
Lynetta Michelle Johnson	Siler City
***Stephen Michael Jones	Pittsboro
H**Frances Michelle Kelly	Biscoe
Teresa Lynn Klatt	Chapel Hill
H Jacqueline Locklear	Rowland
†Debra Ann McLamb	Clinton
***Thomas Benton Moss, II	Enfield
H*Michael Wayne Overton	Oxford
***Daniel John Petrus	Raleigh
Vincent Gregory Pittman	Knightdale
H Cheryl Renee Pope	Winston-Salem
Amanda Anne Shuman	Whiteville
Martha Anne Sneed	Raleigh
†H**Mark Joseph Stehr	Raleigh
William Todd Stroup	Charlotte
†Barbara Anne Wallace	Stanley
Kathy Denise Weaver	Vale
**Ryan Dewayne Weeks	Dunn
Anna Joyce Wheeler	Alliance
Lorie Boyd Wheless	Raleigh
Sharon Leah White	Greensboro
Richard Crouse Wood	Raeford
†Jenny Lynn Worley	Conway

BACHELOR OF SCIENCE IN BIOCHEMISTRY

Degree Conferred June 27, 1985

H***Lisa Ann Darling Raleigh

Degree Conferred August 8, 1985

William Edward Vasser Billingsley, AL

Degree Conferred December 17, 1985

Daniel Winfred Hart Ayden

Degrees Conferred May 10, 1986

H***Laura Jane Benecki Wilmington

H**Walter Lee Briley Robersonville

Warren Michael Casey Raleigh

†**Sarah Louise Dolby Charlotte

Willis Bunch Edmund Chadbourn

H**Carol Gollop George Raleigh

Richard Dean Glassey, Jr. Brooklyn, MI

H***Catherine Mason Gordon Raleigh

H**Leroy Karl Hubbert Ellsworth, ME

Kimberly Lynn Intemann Raleigh

†Nelda Leigh Jeffreys Zebulon

†Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

H	Virginia Ruth Jones	Mooreville
H***	Antoine Boutros Khoury	Andrews
H**	Sanford Harrison Leuba	Raleigh
H***	Eva Carol Pickler	New London
	Lisa Rose Radwan	Califon, NJ
	Kathryn Marie Roberson	Henderson
	Stanley Kent Robinson	Hickory
H***	Rebecca Diane Skaggs	Raleigh
*	Thomas Franklin Stout	Greensboro
	Roger Bryan Sutton	Raleigh
	Angela Hope Thompson	Yaupon Beach
**	Dianne Williams	Cary
H***	James Todd Williams	Charlotte

BACHELOR OF SCIENCE IN BIOLOGICAL AND AGRICULTURAL ENGINEERING

Degrees Conferred August 8, 1985

	Geoffrey Ennis Dietrich	Weddington
	Mahshid Rad Zahed	Tehran, Iran

Degrees Conferred December 17, 1985

	Charles Ernest Blum	Raleigh
	James Craig DeBrew	Shelby
	Michael Steven Ellington	Eden
	John Glenn Faulkner	Louisburg
	Charles Louis Flippin	Graham
	Walter Anderson Hill, Jr.	Clemmons
	Richard Arlen Lewis	Winston-Salem
	Lindsay Lee Mize	Oxford
*	Robin Carol Wiencek	Lexington

Degrees Conferred May 10, 1986

	Michael Dale Branch	Kinston
	Wilton Perry Braswell	Rocky Mount
	Bette Dee Browder	Lexington
	Robert David Collier	Raleigh
	Rocky Donnell Durham	Walnut Cove
	Roger William Fortman	Durham
	James Foy Gann	Asheboro
H***	Gary Robert Hamrick	Bostic
	Ernest Graham Johnson	Ahoskie
	Michael Brian Johnson	Siler City
	Howard Malvin Malinski, Jr.	Graham
	Phil Moore Ross	Greensboro
	Reginald Cameron Rosser	Broadway
	Stephen Wayne Smith	Chesapeake, VA
H*	Alston Wright Spruill, Jr.	Oriental
	Dennis Glenn Sutton	Richlands
	Randal Calvin Thompson	Robbins
	Stuart Kent Walker	Mill Spring
	Wilbur Daniel Ward	Clarkton

BACHELOR OF SCIENCE IN BIOLOGICAL SCIENCES

Degree Conferred June 27, 1985

	Mark Eldridge Overby	Greensboro
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†Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

Degrees Conferred August 8, 1985

Christine Lynn Bruske	Smithfield
Anthony Keane Lantz	Hoffman
Tammy Kay Manning	Thomasville

Degrees Conferred December 17, 1985

Nickie Elizabeth Beeson	Winston-Salem
Michael Dean Bryant	Raleigh
Jean Furnas Harrell	Raleigh
Warren Todd Judkins	Norwalk, CT
Cheryl Johnston Landy	Asheville
H Sheri Veda Lane	Raleigh
H***Gary Blaine Loden	Gastonia
*Andrew Holmes McDaniel, Jr.	Raleigh
*Faye Lawrence Mitchell	Reidsville
***Kelly Thomas Smith	Warsaw

Degrees Conferred May 10, 1986

William Ernest Bakewell, III	Chapel Hill
H Angelia Maria Barnes	Rocky Mount
Allison Lori Burnette	Danville, VA
Jeffrey Haynes Christian	Key West, FL
Christopher John East	Cary
H**Kristie Lee Gingery	Raleigh
H***Amelia Jean Hopkins	Brown Summit
Kirby Allen Lewis	New Bern
Kerri Lesli Martin	Greensboro
†Debra Ann McLamb	Clinton
*David Hagan NeeSmith	Newport News, VA
H**Michael Dean Parker	Vass
H Gloria Faye Putnam	Rocky Mount
H**Charles Joseph Trunks	Wayne, PA
H*Rhonda Yvonne Vega	Durham
Robert Gray Williams, Jr.	Manteo

BACHELOR OF SCIENCE IN BIOLOGICAL SCIENCES (Biochemistry)

Degrees Conferred August 8, 1985

James Konzelman	Boone
†Michael Worley Oddo	Charlotte

Degree Conferred December 17, 1985

Martin Rucker Richmond	Winston-Salem
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BACHELOR OF SCIENCE IN BIOLOGICAL SCIENCES (International Option)

Degree Conferred May 10, 1986

H***Kimberly Gail McLauchlin	Fayetteville
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BACHELOR OF SCIENCE IN BIOLOGICAL SCIENCES (Microbiology)

Degrees Conferred December 17, 1985

Pamela Hill Brown	Raleigh
*Cynthia Ballenger Dray	Raleigh

Degrees Conferred May 10, 1986

Michael Adam Brinkley	Raleigh
H**Darrell Anthony Cope	Cary
Angela Hudson	Boonton, NJ
**Uma Krishnaswamy Nathan	Cary
Lisa Anne Ransbottom	Wendell

BACHELOR OF SCIENCE IN BIOLOGICAL SCIENCES (Nutrition)

Degree Conferred May 10, 1986

Gena Frances Roush	Boone
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BACHELOR OF SCIENCE IN BOTANY

Degree Conferred June 27, 1985

*John Ippie McLeod	Laurinburg
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Degrees Conferred December 17, 1985

Jonathan Dean Anderson	Raleigh
Elizabeth Zweigart Tajiri	Raleigh

Degrees Conferred May 10, 1986

Lynda Helen Curlee	Raleigh
Stanley Eugene McDonald	Holly Springs
H***Melanie Carol Trull	Monroe

BACHELOR OF SCIENCE IN FISHERIES AND WILDLIFE SCIENCES

Degrees Conferred August 8, 1985

Dirk Alan Amtower	Montoursville, PA
Bradford Burton Gunn	Reidsville

Degrees Conferred December 17, 1985

H John Dominick Giorgino	Raleigh
H**Pamela Robinson Giorgino	Raleigh
Tony Lee Pegram	Kernersville
*James William Wetherill	Flourtown, PA

Degrees Conferred May 10, 1986

**Kenneth John Alfieri	Matthews
Everette Gray Allen	Mocksville
Susan Caroline Foster	Lenoir
*William McMillan Hester	Goldsboro
*Elizabeth Olin Jones	Winter Park, FL
H**Kenneth Gerald Rice	Weaverville
Fletcher Alan Sanders	Zebulon
Dolan Lee Shoaf	Lexington

BACHELOR OF SCIENCE IN FOOD SCIENCE

Degree Conferred June 27, 1985

*Helen Louzette Waters	Morganton
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Degrees Conferred December 17, 1985

Billie Marie Moses	Shelby
Frances Gail Umstead	Rocky Mount

†Co-major

*Cum Laude

**Magna Cum Laude

***Summa Cum Laude

H Honors Program

Degrees Conferred May 10, 1986

Bonnie Lee Brewer	Franklin, MA
Michael Dennis Jackson	Dunn
***Sara Ellen McCauley	Durham
Ruth Ellen Mormino	Cary
*Teresa Rebecca Phillips	Princeton Junction, NJ
Rancelle Annette Rowell	Monroe
William Lee Shore	Boonville
Lynne Carol Strauss	State College, PA
H***Anne Elizabeth Tieleman	Riner, VA
Eursula Renee West	Raleigh

BACHELOR OF SCIENCE IN HORTICULTURAL SCIENCE

Degree Conferred June 27, 1985

Thomas Philmore Dellinger, III	Crossnore
Pamela Anne Sizemore	Cary

Degrees Conferred August 8, 1985

***Paul Harold Henry	Raleigh
DeAaon Hoggins	Plainview, TX
Steven Lewis Watson	Chapel Hill

Degrees Conferred December 17, 1985

David Gregory Davis	Dobson
Susan Elizabeth Gauthier	Rockville, VA
†David Theodore Goodson	Mount Olive
Susan Pelletier Harrison	Raleigh
Tammy Denise Kelly	Newport
**Mark Eugene Lancaster	Hendersonville
***Julia Lynne McIver	Richmond, VA
Timothy Wayne Pasour	Dallas
Joseph Clifton Stoffregen	Raleigh

Degrees Conferred May 10, 1986

Geoffrey Lee Anderson	Holkessin, DE
Donna Jean Annand	Gibsonville
Gary Lee Calder	Raleigh
Ronald Franklin Cox	Charlotte
†Mark Durant Crisco	Albemarle
Douglas Randall Evans	Onancock, VA
Ross Gordon Houston	Beulaville
Timothy Lane Jones	Burlington
*Katherine Lynn Kearse	Charlotte
Daniel Reid McConnell	Hendersonville
David Eugene Meyer	Yorktown Heights, NY
Patricia Dianne Moorefield	Raleigh
Stephen Rosier Phipps	Staley
Walter Louis Sadler	Siler City
H*Dina Margaret Samfield	Durham
H Brenda Hudson Surles	Benson
Harriet Byrd Thomas	Charlotte

BACHELOR OF SCIENCE IN MEDICAL TECHNOLOGY

Degree Conferred August 8, 1985

Debra Sue HarrisRoxboro

BACHELOR OF SCIENCE IN PEST MANAGEMENT FOR CROP PROTECTION

Degree Conferred June 27, 1985

Momodou Balancang Sainy CantehSallikenye, The Gambia

Degrees Conferred May 10, 1986

Byron Frederick BassClinton
H**Rocco Dale SchiavoneColumbus, GA
Rebecca Jane WellsFletcher

BACHELOR OF SCIENCE IN POULTRY SCIENCE

Degree Conferred August 8, 1985

Dee SuggGoldsboro

Degrees Conferred December 17, 1985

**Guy Richard BeretichClinton
H*Ronald Jeffrey MartinBeaufort, SC
Larry Douglas MorleyMacomb, IL
Mark Steven PattersonBurlington
Darrell Eugene SniderLiberty

Degrees Conferred May 10, 1986

†Lisa Diane BakerRaleigh
Battle Lawrence BurnetteRaleigh
Garry Scott HillPink Hill
H Ralph Augustus Keel, Jr.Robersonville
Glenda Stikeleather SwannRaleigh
Nancy Sandra SzabadosFayetteville
†Jenny Lynn WorleyConway

BACHELOR OF SCIENCE IN SOIL SCIENCE

Degree Conferred December 17, 1985

H**Diane Fisher UrsoneRaleigh

Degrees Conferred May 10, 1986

Britt Lanning SetzerNewton

BACHELOR OF SCIENCE IN WILDLIFE BIOLOGY

Degree Conferred December 17, 1985

Isaac Judson HarroldRural Hall

BACHELOR OF SCIENCE IN ZOOLOGY

Degrees Conferred June 27, 1985

Jackie Michele DunnGarner
**Mark Lee GloverGarner
Jeffrey Steven SauerSyracuse, NY

†Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

Degrees Conferred August 8, 1985

James Walter Darges	Wayne, PA
Angela Marie Grimes	Todd
Harvette Carmelle Jenkins	Fayetteville
Francis Marvin Taylor	Raleigh

Degrees Conferred December 17, 1985

**William Edward Anthony	Gastonia
*Victoria Ann Carter	Atlanta, GA
Stephanie Jayne Dickens	Fuquay-Varina
JoAnne Marie Duncan	Clayton
LeAnder Dwaine Gray	Ramseur
H***James Dwight Gregson, III	Liberty
Paula Michele Hill	Fayetteville
Lee Ann Hines	Winston-Salem
Stephen Joseph Johnston	Cary
Saundra Lee Landes	Raleigh
William Johnston Mann	Raleigh
Frank Thomas McGhee, Jr.	Henderson
Patricia Hinton Mial	Raleigh
Bennett Todd Morrison	Winston-Salem
H*Jane Kelly Ogle	Raleigh
James Edward Robertson	Taylors, SC
Tracy Suzanne Sherrill	Concord
Harold Edward Smith, Jr.	Raleigh
***Melody Claire Speck	Hampstead
Philip Mark Swigart	Raleigh
Scott Garfield Thompson	Wendell
H*Michael Timothy Tomlin	Concord
H*Joseph Todd Weaver	Bahama
David Byron White	New Bern
Roxanne Wilson	Charlotte

Degrees Conferred May 10, 1986

†H***Ghassan Salim Al-Awar	Karnayel, Lebanon
Gretchen Dudley Aldridge	Durham
**Lawrence Leon Benbow	Winston-Salem
Brian Etheridge Bennett	Winston-Salem
H Steven Keith Bowen	Garner
Scott Paul Calderone	Charlotte
Amy Jo Chenoweth	Durham
Luke David Cicchinelli	Raleigh
H*William Douglas Clark	Raleigh
H**David Martin Cook	Charlotte
H*Stanley Cameron Corbin	Greensboro
Mary Catharine Crotts	Raleigh
H***Maury Lane Edwards	Whitakers
†Mary Beth Farley	Roanoke Rapids
**Steven Brian Gallup	Raleigh
Rondall Kelly Gardner	Walnut Cove
Karla Susan Gertis	Charlotte
†Rebecca Ann Gore	Clarendon
H**Laura Leigh Haigler	Monroe
Selby Blake Hawley	Wilson
Karen Lee Hill	Greensboro

†Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

James Edward Ingold, Jr.	Durham
Theresa Jeanne Jakos	Raleigh
†Nelda Leigh Jeffreys	Zebulon
H Saba Jelokhani	Raleigh
Madeleine Sophie Jiamachello	Fayetteville
Pamela Jean Jones	Zebulon
*Regina Marie Julian	Raleigh
**Sandra Anne Justis	Concord
†***David Widiiah Koury	Sanford
†H*Evelyn Victoria Lineback	Clayton
H**Donna Maclain Marlowe	Charlotte
H**Julie Adair Martin	Ramseur
H***Rachel Ann McKenzie	Raleigh
H***Kelley Elizabeth Morris	Charlotte
H**William Mark Oliver	Kinston
William Scott Oliver	Williamsburg, VA
H***Anita Ann Pardue	Rural Hall
*Terri Michele Parker	Ahoskie
Melissa Elizabeth Petty	Henderson
Royce Anthony Porter, Jr.	Winston-Salem
H*Grady Leon Robbins, III	Winston-Salem
Michael Shawn Seebo	Richmond, VA
H*Helen Louise Silva	Wilmington
Paula Danette Smith	Raleigh
Susan Haynes Speed	Tarboro
Reneé Vivian Thompson	Wake Forest
†Barbara Anne Wallace	Stanley
Jonathan McKeffers White	Greensboro
Darlene Rita Willey	Cary
Patty Jo Womble	New Hill
***Cindy Joy Yetka	Goldsboro
Zizi Annette Zaalouk	Raleigh

School of Design



BACHELOR OF ARCHITECTURE

Degree Conferred December 17, 1985

Billy Roderick Flowers, II Raleigh

Degrees Conferred May 10, 1986

***John Scott Crowe Denver
James Malcolm Hawkins Roxboro
Dawn Branch King Winterville
William Harold Riggs, III Richmond, VA
Michael Erwin Russell Glenville
Richard Robert Schoellkopf Cherry Hill, NJ
Walter Paul Stellpflug Raleigh

†Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

**Michael George Stevenson	Henderson
Charles Leroy Travis, III	Statesville
Erich John Wilkinson	Winston-Salem
Julia Leigh Wilson	Statesville
James Carlton Winstead	Hendersonville
Phillip Zook	Reedville, VA

BACHELOR OF ENVIRONMENTAL DESIGN IN ARCHITECTURE

Degree Conferred June 27, 1985

John Allen Knight, Jr.	Burlington
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Degrees Conferred August 8, 1985

Walid Fouad Ataya	Beirut, Lebanon
James Malcolm Hawkins	Roxboro
Kimberly Ann Herring	Broadway
Richard Munger Preyer	Southern Pines
James Elmer Rice, Jr.	Cary
William Frank Strickland	Cerro Gordo

Degrees Conferred December 17, 1985

*Harold Morrow Bowen	Cary
Michael Wayne Brown	Fayetteville
†Stephen Andrew Lauria	Chapel Hill
Robin Jo Stancil	Wilson
Ann Elizabeth Wackerhagen	Pfafftown
**Betsy Carol West	Shelby
John Thomas Yount	Reidsville

Degrees Conferred May 10, 1986

*Deborah Anyon Anglin	Raleigh
Nilse Carolina Bracho-de-Pisani	Caracas, Venezuela
**Kimberly Anne Brooks	Laurinburg
Ray Randall Campbell	Kernersville
Cynthia Anne Curley	Valley Forge, PA
*Gerardo Alberto Dabdub	El Salvador, C.A.
Michael Anthony de Haas	Charlotte
Mona Elizabeth Douglass	Williamston
***Michael Lee Dudley	Fairfax, VA
**Cooper Gabriel	Gibson, FL
***James Edward Gordon	Raleigh
*Douglas Lee Hall	Sanford
*David Edward Harwood	Albemarle
Brenda Gail Hayes	Brown Summit
Stacey Ellen Hendricks	Annapolis, MD
John Clark Hipp	Charlotte
*David Edward Kropp	Chapel Hill
Douglas Lee Lawing	Charlotte
Richard Charlton Lewis	Clemmons
Bedford Jackson Page, Jr.	Yanceyville
Christopher David Patrick	Cary
Scott Gary Rogers	Salisbury, MD
Larry Dwaine Sherrill	Mooresville
Andrew Morgan Sohn	Charlotte
***Kimberly Leigh Thrower	Rocky Mount
*Leonard Cornelius Van Staalduinen	Pantego
Victor Vines	Pinetops
**Cheryl Jean Williams	Raleigh

†Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

BACHELOR OF ENVIRONMENTAL DESIGN IN LANDSCAPE ARCHITECTURE

Degree Conferred December 17, 1985

†Stephen Andrew LauriaChapel Hill

Degree Conferred May 10, 1986

Christopher Ray PopeSalisbury

BACHELOR OF ENVIRONMENTAL DESIGN IN PRODUCT DESIGN

Degrees Conferred June 27, 1985

**Robert Waide Holmes, IIIAsheville

*Darrell Mathias MerinoRaleigh

Degrees Conferred December 17, 1985

**Peter Blevins BarronChapel Hill

Vincent Lee BrooksDurham

Glenn Eric DorshimerLansing, MI

*James Randall LeMayRaleigh

Matilda McDonald ParkerRaleigh

Linda Jane PerryTarboro

William Edward Schaaf, Jr.Gloucester

Degrees Conferred May 10, 1986

†Christopher Robb BarnardGreensboro

***Thomas Matthew BaumKitty Hawk

Reid Stratton CoynerRaleigh

Paul Bradley ForrestMorganton

Cornelia Judith GildemeisterLima, Peru

Brandy NoonRaleigh

Joseph Blair SlaughterFuquay-Varina

BACHELOR OF ENVIRONMENTAL DESIGN IN VISUAL DESIGN

Degree Conferred June 27, 1985

JoAnne Barbara MoyerRaleigh

Degrees Conferred August 8, 1985

David Earl MitchellGreensboro

Pamela Sue PowersWinston-Salem

Degrees Conferred December 17, 1985

Alice June MartinTaylorsville

Sallianne Marie MillerCary

Marion Gamble PeteschRaleigh

Donna Lynne TysonWilson

Degrees Conferred May 10, 1986

†Christopher Robb BarnardGreensboro

Diana Lynn BoydCharlotte

*Karen Helga ConneryDurham

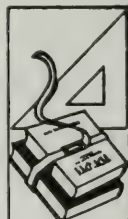
Maria Jeannette HolmesCharlotte

Marcus Howard ManleyNorman, OK

Kimberly Ann MarlattGarner

John Thomas Midyette	Raleigh
Michael John Muscarella	West Hampton, NY
Kenneth Lawrence Sellet	Chapel Hill
Laurin Ann Smith	Morehead City
Mary Catherine Sox	Fuquay-Varina
**Wendy Ann Wichtrich	Cary
Stephen Hayes Willis	Garner

School of Education



BACHELOR OF ARTS IN PSYCHOLOGY

Degrees Conferred August 8, 1985

Philip William Hewett	Durham
*Denise Marie Malloy	Raleigh
Timothy Mark Newton	Creedmoor

Degrees Conferred December 17, 1985

†Diane Thomas Alley	Raleigh
Angela Antonelli	Fayetteville
Johnnie Denise McBride	Mocksville
James Lee Still-Papper	Miami, FL
*Susan Nnadozie Umeozor	Ezinifite (Nigeria), Anambra

Degrees Conferred May 10, 1986

*Joy Ruth Ammons	Fayetteville
Mary Beth Ballard	Fuquay-Varina
Julie Lynn Boy	Durham
*Patrick Herbert Cox, Jr.	Charlotte
Larry Brent Davis	Taylorsville
Mary Leanne Floyd	Laurinburg
Pamela Jo Foster	Raleigh
Phillip Van Gordon	High Point
Charlotte Nash Hughes	Raleigh
Kelly Renee Hutchins	Raleigh
**Geraldyn Klisiewicz	Benson
*Elaine Luddy Klonicki	Raleigh
Rachael Ann Kurzer	Drexel
Cheryl Johnston Landy	Asheville
**Amy Melissa Lee	Lillington
Steven James Long	Jacksonville
Elizabeth Robin Lynch	Winston-Salem
Joan Lois Miller	Pink Hill
Nancy Gellert Miller	Marietta, GA
Amy Hagaman Rabbani	Winston-Salem
**Carol Lamb Resar	Raleigh
Jack Ronald Rickman, Jr.	Fayetteville

Fran Gilla Sapir	Silver Spring, MD
Angela Dawn Sullivan	Pine Level
**Edward Lee Thomas	Wilmington
*Kathleen Cyr Townsend	Washington, DC
Dana Harrison Warren	Raleigh
Wayne Lee Wilson	Jacksonville

BACHELOR OF SCIENCE IN EDUCATION

Agricultural Education

Degrees Conferred August 8, 1985

Richard Martin Dowless	Bladenboro
Andy Neal Hare	Tyner
John Michael Pope	Maiden
Jeffrey Haywood Suggs	LaGrange
Michael Sutton, Jr.	Kinston

Degrees Conferred December 17, 1985

Curtis Lynn Cloaninger	Statesville
Danny Charles Greene	Cerro Gordo
Douglas Zack Ladd	Yadkinville
Gregory Gerald Simmons	Kinston
Beasley Berry Strickland	Tabor City

Degrees Conferred May 10, 1986

Henry Matthias Barrier	Mount Pleasant
Curtis Greylon Barwick	Seven Springs
**Robert Daniel Blake, III	Mount Gilead
Daniel Madison Buffaloe	Raleigh
YoLonda Iris Byrd	Staley
*Dale Scott Cochran	Concord
*Crawford Monroe Enzor, III	Fair Bluff
Jeffrey Scott Faison	Roanoke Rapids
Ronald Wood Fish	Willow Springs
*Christopher Warren Hood	Hickory
Barry Wilson McKee	Fallston
David Brian Mitchell	Raleigh
Timothy Wayne Pasour	Dallas
Maria Diane Sapp	Winston-Salem
Pamela Phillips Senter	Fuquay-Varina
James Thomas Skinner	Wilson
Ralsa Marshall Stewart, Jr.	Greenville
Tyres Gralen Tatum	Stoneville

General Studies

Degrees Conferred December 17, 1985

Abigail Hope Epperson	Kenbridge, VA
Charles David Gilmore, Jr.	Sanford
*Carol René Manning	Raleigh
Johnny Ray Outlaw	Mount Olive

Degrees Conferred May 10, 1986

John Robert Moran	Raleigh
John Lisker Tart, II	Goldsboro

Health Occupations Teacher Education

Degrees Conferred December 17, 1985

*Iris Whaley Ahlheit	Raleigh
**Gleniss Irene Sundheimer	Tucson, AZ

Degrees Conferred May 10, 1986

***Spence Macon Foscue	Durham
***Jeanette Jenkins Iacona	Ellerbe

Industrial Arts Education

Degree Conferred June 27, 1985

**Samuel Perry Harrell	Limuru, Kenya
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Degrees Conferred December 17, 1985

Cameron Jay Cuthrell	Elizabeth City
Anthony Antoine Dowell	Wilkesboro
Steven Bennett Garrett	Wilmington
Richard Scott Jones	Raleigh
Arthur John Koop	Raleigh
Leslie Hope Leonard	Raleigh
James Leo Parker	Raleigh
Kenneth Todd Stott	Raleigh

Degrees Conferred May 10, 1986

Jeffrey Porter Booth	South Bend, IN
Daniel Richard Waters	Danville, VA

Mathematics Education

Degree Conferred June 27, 1985

*Elizabeth Dale Cox	Atlantic
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Degrees Conferred December 17, 1985

†*Melissa Anne Beretich	Clinton
Melinda Ann Coughlin	West End
Mary Alice Furr	Monroe
Cynthia Darlene Goins	Pinnacle
*Jennifer Annette Roberts	Raleigh
Sharon Lynne Sammons	Knightdale
†Claudia Grace Smith	Rocky Mount
*Lisa Marie Spizzo	Conover

Degrees Conferred May 10, 1986

***Dianne Marie Baetz	Endicott, NY
Loyd Bradshaw, III	Suffolk, VA
Cindy Dawn Clark	Youngsville
Rodrick Scott Dooley	Taylorsville
Kevin Gordon Dotterer	Zebulon
†John Talbert Jackson	Winston-Salem
Carol Louise Nice	Durham
Carol Lynne Osborne	Burlington
David Clarence Siler	Raleigh
Nell Faison Sloan	Wallace

**Darla Jill Strickland	Zebulon
†**Jill Karen Thompson	Zebulon
***William Anthony Wood	Durham

Middle Grades, Language Arts

Degrees Conferred December 17, 1985

Allison Anne Crotty	Fork, MD
Linda Leigh McBrayer	Forest City

Middle Grades, Social Studies

Degree Conferred June 27, 1985

**Richard Anthony Cantlupe	Middlesex, NJ
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Degree Conferred December 17, 1985

Beth Shannon Coley	Franklinton
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Middle Grades, Science

Degree Conferred May 10, 1986

Anita Denise Cosper	Wilmington
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Science Education

Degrees Conferred August 8, 1985

†Pierette Banker	Plattsburgh, NY
Robbin Ellery Lee	Burlington

Degrees Conferred December 17, 1985

*Bess Currin Adcock	Oxford
Nancy Elizabeth Bunn	Raleigh
Nancy Murphy Hodges	Charlotte
Roscoe Blaine Jones	Garner
Patrick Alan Lennon	Fairmont
Katherine Susan Lloyd	Saint Petersburg, FL
Lisa Page Marley	Winston-Salem
***Martha Varner McCullen	Cary

Degrees Conferred May 10, 1986

**Donna Kimberly Baker	Clayton
Christy Deloris Crumpler	Goldsboro
Angela Dee Plott	Bryson City
Claude Eric Simmons	Macon, MS
Virginia Yow Stewart	Jacksonville
Ann Elizabeth Tharpe	Mooreville

Technical Education

Degrees Conferred December 17, 1985

Theodore Joseph Branoff	Zebulon
Neal Clark Phillips	Bear Creek

Vocational Industrial Education

Degree Conferred December 17, 1985

Steven Russell Saulnier	Jersey City, NJ
-------------------------------	-----------------

†Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

Degree Conferred May 10, 1986

Joseph Michael Milinichik Macungie, PA

School of Engineering



BACHELOR OF SCIENCE IN BIOLOGICAL AND AGRICULTURAL ENGINEERING

Jointly administered by the School of Agriculture and Life Sciences and the School of Engineering.

Degrees Conferred May 10, 1986

Robert Stephen Adcox	Battleboro
*Tilman Bradley Bennett	Jamesville
Debra Bryant Benoy	Forest City
Marcel Daniel Bingham	Raleigh
*Gregory Bruce Blanchard	Palm City, FL
Jill Elizabeth Burton	Cary
Gary Edward Coppock	Lewiston, NY
*David Michael Crohn	Winston-Salem
William Allen Hardy	Rocky Mount
Barbara Lynn Hayes	Raleigh
Debra Ann Hopkins	Saratoga, NY
Tracy Lane Johnson	Dunn
Todd Ervin Lineberger	Taylorsville
Henry Wallace Spruill, Jr.	Creswell
*David Bradley Williams	Advance

BACHELOR OF SCIENCE IN AEROSPACE ENGINEERING

Degrees Conferred June 27, 1985

Robbie Douglas Atencio	Albuquerque, NM
Richard Arthur Connell	Hendersonville
Wendy Anne Edwards	Morehead City
Bradford Lee Hazzard	High Point
*Martin Walter March	Winston-Salem
Timothy Gray Muse	Winston-Salem
Gary Lee Whitley, Jr.	Charlotte

Degree Conferred August 8, 1985

*Karen Elaine Corne	Fayetteville
---------------------------	--------------

Degree Conferred December 17, 1985

Christopher David Cotts	Alexandria, VA
-------------------------------	----------------

†Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

Degrees Conferred May 10, 1986

†Jacqueline Marie Amidon	Havelock
Philip David Bissette	Winston-Salem
Danny Ray Bouldin	Bennett
Philip Jay Eberspeaker	Sanford
Christopher John Fitzgerald	Alexandria, VA
Jack Richard Hall, Jr.	Greensboro
Thomas Anthony Hecmanezuk	Akron, OH
*Charles Ernest Hedgecock	Winston-Salem
John Frederick Higdon	Charlotte
Claude Allan Kidd	Greensboro
**Scott William Mackall	Leola, PA
Daniel Lynn Marlowe	Asheville
Holly Faythe Meyer	Raleigh
Chad Cooke Miller	Huntersville
James Edwin Miller	Hickory
James Nelson Miller	Cary
Stephen John Moore	Wilmington
Michael Dean Mountcastle	Dunn
Gregory Scott Patterson	Whitakers
David Luke Pierce	Jacksonville
Jonathan Ray Pierce	Charlotte
James Christopher Pugh	Roanoke, VA
Clifford Lewis Ratliff	Chapel Hill
***Christopher Joseph Riley	Newton
Alvin Bradley Starnes	Faith
John Aaron Thompson	Greenville
**Brian Michael Turpin	Athens, GA
William Jonathan Whitacre, III	Greensboro
***Chad Joseph Yetka	Goldsboro

BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING

Degrees Conferred June 27, 1985

Lisa Arrington Creech	Raleigh
Ziad Faiz Husein	Buffalo, NY
***Joe Randall Noles, Jr.	Fayetteville
Gregory Paul Ramsey	Raleigh
Suzanne Olivia Sanborn	Havelock

Degrees Conferred August 8, 1985

Bruce Owen Griffin	Lenoir
Gregory Paul Hatem	Roanoke Rapids
*Roy Hampton Huntley	Raleigh
Michelle Harriet Keaton	Stony Point
Donna Lea Smith	Goldsboro

Degrees Conferred December 17, 1985

James Edward Adams, III	Morehead City
Louay Akil	Charlotte
Angela Robin Barker	Warrensville
†Richard Byrd Barnes	Wilmington
*Samuel Young Bridges	Sanford
David Jonathan Cheek	Canton

†Benjamin Franklin Dowell	Winston-Salem
Kenneth Ivan Gandy	Raleigh
†Roy Arston Grant	Stone Mountain, GA
*Edward Eugene Granzella, Jr.	Fayetteville
*Harri Johannes Haikala	Matawan, NJ
Mark Stephen Hedrick	Lexington
Alan Kyle Henderson	Newport
Paul Wank Koda	Chapel Hill
Joseph Robert Lancaster, Jr.	Mebane
Michael Douglas Lowry	High Point
Patricia Ann McKone	Southern Pines
James William Meyers	Shoreham, NY
Theresa Annette Parker	Erwin
Michael O'Briant Parrott	Oxford
*Grace Gardner Patton	Roanoke Rapids
*James Frederick Phil	Stanley
*Leigh Anne Proctor	Huntersville
***Jeffrey Richard Reese	Raleigh
Stephen Richard Robbins	Aberdeen
Bernard Roberts	Stovall
*John Backland Scarff	Morehead City
Steven Lloyd Scheye	Pensacola, FL
Calton Bruce Spivey	Raleigh
†Gary John Steiger	Pensacola, FL
Michael Keith Taylor	Rocky Mount
Hill Carrier Teachey, III	Wallace
†Hong My Truong	Raleigh
†Pamela Evada Tyndall	Asheville
José Ramón Vendrell	Ponce, PR
Jasiah Benjamin Vick	Nashville
Kelly Anne West	Edenton
Gary Lynn Williams	Oxford

Degrees Conferred May 10, 1986

William Wayne Arrington	Greensboro
*Linda Deanne Benson	Raleigh
**William David Branoff	Zebulon
**Stacy Adele Brewer	Dunn
Nicole Francine Brown	Kinston
Jeffrey Allen Buffo	Germantown, MD
†Charles David Burton, Jr.	Charlotte
Candace Joy Cable	Canton
**James Anthony Chambers	Wake Forest
**Michael Brian Christie	Charlotte
Kenneth Harold Cooper	Sparta
*Bruce Russell Cox	Raleigh
Jeffrey Scott Denton	Canton
Julian Caldwell Shannon Drew	Raleigh
James Francis Faulstich	Raleigh
**Reginald O'Keith Frazier	Goldsboro
†John Eyster Garnett	Greenwich, CT
†Robert West Graham	Burlington
Bruce Howard Hamilton	Grand Lake, CO
*Angela Lynette Jennings	Asheville
David Brian Johnson	Clayton
James Robert Jones, Jr.	Panama City, FL
†Katherine Elizabeth Keever	Granite Falls

†Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

†*Evelyn Victoria Lineback	Clayton
*Peter Benson Lloyd	Morganton
†*Jo Karen Lowman	Raleigh
Myron Neal McElveen	Savannah, GA
Susan Josephson Miller	Cary
**John Calloway Moreland	Raleigh
June Diane Morrison	Charlotte
**William David Orbeck	Greenville
Joseph Romus Pearce, Jr.	Wake Forest
***Keith Gregory Pierce	Charlotte
**Kathy Ann Pividal	Bogota, Columbia
Jeffrey Carroll Queen	Catawba
*Kenneth John Questell	Oxford
Ellen Marie Reap	Charlotte
***Irene Ai Reynolds	Wilmington
Bruce Carroll Robinson	Canton
**Douglas Lee Schwartz	Kinston
David Thomas Sidbury	Hampstead
**Sarah Louise Skillman	Wilmington
Gregory Harry Stehr	Flanders, NJ
David Michael Sudano	Bohemia, NY
John Reid Tilley	Oak Ridge
Gail VandenBout	Pinehurst
***Sherri Lynn Vesalga	Sanford
*Anthony Scott Voiers	Winston-Salem
Dana Kay Wernsman	Raleigh
†Everett Grady Wetherington	La Grange
***Roger Dean Whitley	Wilson
Randall Malcolm Wisinger	Toledo, OH

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

Degrees Conferred June 27, 1985

Winston Trent Anderson	Marble
Jane Harley Daniel	Smithfield
Lawrence Allan Hill	Greensboro
Alan Carter Lewis	Shallotte
Samuel Grimes McCachern	Winston-Salem
Karen Lynn Minier	Asheboro
***John Michael Talley	Knightdale

Degrees Conferred August 8, 1985

Amanda Jo Aldridge	Natural Bridge, VA
Jeffrey Leon Picklesimer	Sylva
Ronald Keith Readling	Cornelius
Brian Douglas Scarboro	Raeftord
David Wayne Spainhour	Rural Hall
Glenn Stewart	Dunn

Degrees Conferred December 17, 1985

Raymond Scott Allen	Concord
Dwayne Hayes Alligood	Plymouth
Dennis Edward Askew	Plymouth
Kenneth Wayne Beane	Goldsboro
Kathryn Connor Beard	Raleigh
William Calvin Britt	Murfreesboro

†Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

Scott Douglas Blevins	Jefferson
Michael Wayne Bynum	Alexis
Francis Stuart Carson	Elizabethtown
David Eugene Cates	Hillsborough
*Nancy Newell Clayton	Roxboro
William Jeffrey Cox	Clarkton
Paula Gee Davis	Chapel Hill
Curtis Scott Flanagan	Farmville
Michael Phillip Griffin	Marshville
Karen Wynne Hall	Charlotte
Lynwood Eugene Harris, Jr.	Creedmoor
Tina Lynn Hawkins	Raleigh
Lori Spencer Huffman	Hickory
Jay Christopher Jackson	McLean, VA
Mary Kathryn Keiser	Alexandria, VA
Robert William Keistler	Rock Hill, SC
Michael Jerry Kennon	Raleigh
Jeffrey Lee Kornegay	Goldsboro
*James Hopkins Lewis	Powhatan, VA
Kathryn Eleanor Lyne	Boone
Eric Thomas Misenheimer	Statesville
Julius Stephen Moore	Wilmington
Thuy Thi-Thu Nguyen	Raleigh
Andrew Taylor Nottingham	Raleigh
Maria Ngoc Huong Pham	Raleigh
Christopher Thomas Phillips	Garner
Keith Boger Price, Jr.	Charlotte
Jamil Salem Qurneh	Raleigh
Joseph Clark Readling	Cornelius
David Jack Savage	Monroe
Stephanie Laughter Sudano	Hendersonville
*Harry Joseph Tappen	Randolph, NJ
Michael Patrick Trew	Rocky Mount
Todd Alan Tripp	Ayden
Joellyn Willoughby	Baltimore, MD

Degrees Conferred May 10, 1986

Thomas Hudson Agnew	Raleigh
Donald Haney Arant	Charlotte
Kenneth Calvin Batchelor, Jr.	Wilmington
*Paul Randall Blanchard	Virginia Beach, VA
Danny Bruce Bridges	Ellenboro
Jeffrey Todd Brooks	Raleigh
John Osborne Brown	Cleveland
Johnny Mack Brown	Clyde
Max Lee Buchanan	Sylva
James Edward Canfield	Charlotte
James Michael Carpenter	Marshville
*Gregory James Churchill	Greenville
**Stanley Smerdon Clayton	Creedmoor
Kenneth Charles Cole	Sanford
***David Marshall Collins	Rockingham
Gregory James Connors	Vestal, NY
†Troy Alvin Doby, Jr.	Raleigh
David Scott Edwards	Hendersonville

†Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

Thomas Lee Foreman, Jr.	Greensboro
Michael Garofalo	Point Pleasant, NJ
Linda Gail Grimes	Raleigh
Marc Leslie Hamel	Wilmington
Teresa Ann Hart	Havelock
David Lynn Hensley	Garner
Charles Norman Hill, Jr.	Bahama
Christine Marie Hinkley	Pittsboro
Stanley Scott Hodges	High Point
Stephen Patrick Ivey	Reidsville
Michael William Johnson	Raleigh
*Virginia Duskin Jones	Raleigh
Timothy Gilmore Kennedy	Sanford
Charles Randall King	Beaufort
Jeffrey William Kolb	Wilmington
***Harold Eugene Lewis	Charlotte
*William Kenneth Malpass	Goldsboro
Houssein Abdullah Matar	Beirut, Lebanon
Arthur Reese McMillan	Danville, VA
Bruce Edward Miller	Greensboro
Teresa Elene Moore	Raleigh
Clyde David Moorefield	Raleigh
***David Andrew Nailor	Durham
David Kenneth Newsom	Morehead City
Bharatkumar Damodardas Padia	Bhavnaqar, India
Hildred Wesley Parham	Durham
Hitesh Chhotubhai Patel	Mount Airy
Archie Cameron Patterson	Sanford
***Douglas David Peeler	Burlington
**Kevin Nolan Poythress	Cary
Steve Eugene Ratzlaff	Quinton, VA
Scott Reed Robertson	Beckley, WV
Edward Douglas Seagle	Drexel
Joel Bobby Setzer	Cullowhee
***Robert Wayne Stocks	Raleigh
Daniel Lee Thomas	Asheboro
Joseph Stuart Thompson	Tarboro
Patrick Lee Tuttle	King
Fred Merton Van Tassel	Raleigh
Steven Senter Whitt	Raleigh
Jesse Walter Wilson	Smithfield
***Felix Yu-Chung Wong	Kuala Lumpur, Malaysia

BACHELOR OF SCIENCE IN CIVIL ENGINEERING— CONSTRUCTION OPTION

Degrees Conferred June 27, 1985

Carmie Dennis Cloud	Wadesboro
Steven Rudy Davis	Raleigh
Nabil Ahmad Hasan	Jordan, Jordan

Degrees Conferred August 8, 1985

Lyman Lewis Edwards, Jr.	Grimesland
Sharif Ahmed Husein	Al-Sawya, Palestine
William Edward Martin	Jackson

Degrees Conferred December 17, 1985

Donald Ray Adams	Durham
Thomas Billings Barnett	Charlotte
Jerome James Beard	Lenoir
Richard Alan Broome	Charlotte
Douglas Leland Dowell, Jr.	Charlotte
Bradley Scott Eller	Winston-Salem
Craig Steven Fleming	Thomasville
Thomas Raine Freeman	Goldsboro
Mark Joseph Herbert	Raleigh
Douglas James Hunt	Greensboro
Timothy Johnson	Greensboro
Ayman Hamdi Khader	Amman, Jordan
Stephen Bruce Leonard	Mount Airy
Robin Louis Sauer	Asheville
Samuel Garland Stephens	Winston-Salem
Kevin Duane Taylor	Chapel Hill
Kenneth Roy Tysinger	Thomasville
Robert Scott Whittle	Winston-Salem

Degrees Conferred May 10, 1986

Abiodun Zaccheus Abegunrin	Raleigh
Juan Ivan Baez Satizabal	Bogota, Columbia
Mark Roberts Blankinship	Raleigh
John Stuart Bourne	Sandston, VA
**Vicki Sue Wagner Bush	Marinette, WI
John Thomas Coates, IV	Hendersonville
James Robert Dunlop	Raleigh
James Alexander Gaines	Raleigh
Alfred Leroy Grandy, Jr.	Williamston
*Joseph McPhail Hatcher, Jr.	Fayetteville
David Bryan Hull	Fallston
Terry Neal Keever	Taylorsville
Claudette Marie Kimsey	Lexington
Todd David Leger	Charlotte
Robert Carroll Moser	Greensboro
Mark Evan Puckett	Hamlet
David Franklin Reese	Hickory
Steven Villis Robinson	Reidsville
*Steven Kent Rogers	Asheville
Roy Markham Stewart	Sanford
Kevin John Sullivan	Raleigh
Bruce Samuel Surface	Raleigh
Russell Dean Underwood	Sanford

BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING

Degrees Conferred June 27, 1985

Damon Garner Clary	West Palm Beach, FL
Robert Joseph Delano	Belmont
†**Karl Claudius Garrison	Raleigh
Robert Wayne Griffin	Rocky Mount
†Lee Roy King	Waynesville
Larry Lee Long	Catawba
John William Plisko	Newport
Hood Lance Richardson	Washington

†Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

*Michael LeRoy Riddle	Raleigh
**Jack Edward Stafford, Jr.	Burlington
Charles William Summey	Savannah, GA
Edward Colmery Sutton, Jr.	Burlington
Charles Christopher Vogt	Charlotte
Brian Bernard Walch	Winston-Salem
Ian Tragarron Walker	Fayetteville
James LeRoy Wennermark, Jr.	Raleigh

Degrees Conferred August 8, 1985

Kerry Lee Barlow	Lenoir
Richard Hughes Bazemore	Richmond, VA
**Andrew Thomas Brown	Huntsville, AL
James Raeford Davis, Jr.	Roanoke Rapids
***Gary Stephen Hess	Winston-Salem
***Thomas Ashford Hughes, Jr.	Raleigh
*Kerry Johnson	Havelock
William James Kalin	Raleigh
Gregory David Lewis	Raleigh
Charles Richard McBane, Jr.	Snow Camp
Clayron Bryan McCain	Cameron
John Radie Moseby	Cary
Jaideep Prakash	Raleigh
Robert Thomas Seay, Jr.	Raleigh
Todd David West	Atlanta, GA
John Paul Whited, Jr.	Mebane
Katie Alfreda Wiggins	Wallace
Douglas Clayton Winters	Kernersville

Degrees Conferred December 17, 1985

Curtis Keith Aasen	Severna Park, MD
Joel Spencer Barnhill	Stokes
*Anthony Wade Barrow	Snow Hill
Thomas David Boos	Clearwater, FL
Stuart Glenn Bridges	Alexander
William Gene Callahan, Jr.	Raleigh
Charles Kevin Carlin	Asheville
Arthur Everett Chadwick	Hockessin, DE
***Darol Chamberlain	Raleigh
Kathryn Lee Clark	Wilson
**Bryan David Conley	Glenn Dale, MD
**Gary Edward Cook	Raleigh
**Ricky Nelson Cooper	Enfield
Carlos Correa	Raleigh
Barry Rex Courie	Jacksonville
Thomas Joseph Crozier, III	Charlotte
Jan Antoine Davis	Kinston
Kathy Denise Davis	Lumberton
William Joseph Davison	Rochester, NY
Kimberly Sue Dover	Gastonia
David Michael Drake	Cary
Gail Ann English	Gastonia
David Lee Erwin	Greensboro
David Alan Fike	Charlotte
Darrell Scott Fleming	Kannapolis
Donald Wayne Fowler, II	Zebulon
Bentley Dean Frink	Shallotte

Janet Marie Gallagher	Jamestown
Rodney Odell Garner	Denton
Donnie Lee Goins	Madison
Eugene Vernon Grace	Chapel Hill
***John Franklin Hardy	Snow Hill
Kyle Howard Harris, Jr.	Greensboro
George Mitchell Hatem	Roanoke Rapids
Jerry Scott Hedspeth	Granite Falls
***Anthony Girard Heib	Fayetteville
***James Jay Hershberger	High Point
Walter Asa Hiatt	Greensboro
*Paul Maciej Jezioranski	Raleigh
***Paul McKendree Johnstone, Jr.	Rougemont
Christopher MacDonald Joyner	Murfreesboro
James Spencer Knox	Wilkesboro
Sanjiv Kumar	Charlotte
William Albert Layton, Jr.	Sanford
Mark Alan Lipford	Ruffin
**Lisa Ann Loeffler	Seattle, WA
**David Paul McClure	Asheville
Gerald Michael McGinty	Charlotte
John Parker McNeill, Jr.	Norwood
*Randall Wade McQueen	Norman
Daniel Vance Miller	Cary
Frederick Monroe Miller, III	Columbus, GA
**Keith André Miller	Raleigh
Clay McCoy Mooring	Snow Hill
Gregory Floyd Mulholland	Cary
Frederick Keith Nehrings	Washington, NH
*George Rodney Nelson, Jr.	Morehead City
Phu Minh Nghiem	Saigon, Vietnam
Diep Ngoc Nguyen	Raleigh
*Thinh Xuan Nguyen	Raleigh
Magda Mai Nicola	Greensboro
*David Leonard Overby	Mount Airy
**Gene Shih-Ching Pao	Raleigh
Francis Eugene Pennisi	Raleigh
Matthew Brian Pereira	Plymouth, MA
Dwayne Mitchell Perry	Raleigh
Victor Marlin Powley, Jr.	Cary
John Asa Price	Dudley
Trezvance Robertson	Winston-Salem
Peter Gerald Roux	Charlotte
John David Rowan	Matthews
Stephen Earl Russell	Snow Camp
David Edgar Sanders	Chapel Hill
David Ronn Schlesinger	Chapel Hill
*William Kevin Seyler	Durham
*Lewis Jake Shaw	Chadbourn
Anthony Gerald Sholar	Maple Hill
Roger Glenn Shook	Hickory
David Beardsley Slater, Jr.	Poughkeepsie, NY
Kenneth Smith	Jacksonville
Gregory Philip Stone	Raleigh
Charles Eugene Strickland	Rocky Mount
Thomas Arthur Sutton	Elizabeth City
Alexander Szabo	Raleigh
*Dennis James Taylor	Harrisburg

†Co-major

*Cum Laude

**Magna Cum Laude

***Summa Cum Laude

H Honors Program

George Milton Thomas	Cameron
Michael Eric Thomas	Black Mountain
Carl Bray Toot, Jr.	Kinston
Thanh Kien Tran	Winston-Salem
†Tuy Quoc Tran	Raleigh
†Hong My Truong	Raleigh
**James Lloyd Wall, II	Concord
***Samuel Jacob Wallin	Huntersville
Jay Whitley Weeks	Garner
James David Williams	Wadesboro
Stanley Howard Williams	Kinston
**William Eric Zieg	Goldsboro

Degrees Conferred May 10, 1986

John Adjaye	Saint Thomas, Virgin Islands
James Warren Alford	Raleigh
**Ryan Lester Allison	Etowah
***Kevin Darrell Barnett	Jackson, KY
Rolin Farrar Barrett, Jr.	Raleigh
Kenneth Tumblyn Bell	Cullowhee
**Richard Curtis Bisbee, Jr.	Greensboro
Donna Lynn Bishop	Raleigh
***Cheryl Diane Bolin	Wilmington, DE
Danny Todd Bolin	Aberdeen
**Gregory Thomas Brauns	Greensboro
Matthew Robert Bray	Wallace
**Michael Thomas Brewer	Raleigh
**Jeffrey Ellis Byrd	Ramseur
***Mansung Cho	Raleigh
**Alan Hedgecock Clark	Greensboro
George Allen Clement, Jr.	Raleigh
*Craig Lewis Cloud	Cullowhee
Joseph Leston Collins	Winston-Salem
Michael Edwin Cooper	Winston-Salem
Loy Franklin Cordell	Kernersville
Tammy Faye Crews	Kernersville
Richard Herbert Curtis	Raleigh
*Taumi Sill Daniels	Goldston
***Ian Robert Davies	Matthews
Gary Wayne Dawson	Raleigh
†Phillip Anthony Dean, Jr.	Raleigh
Davis Oliver Diehl	Raleigh
Donnie Ray Dimsdale	Rutherfordton
†David William Easter	Cary
Mary Angela Edmundson	Warsaw
**Mark Bancroft Edwards	Wahiawa, HI
***Donald Brian Eidson	Salisbury
**Barry Todd Ellington	Henderson
**Donna Ruth Etheridge	Robersonville
**Patricia Ann Fadgen	Havelock
*Christine Susanne Falter	Apex
*John William Fetzner	Raleigh
Gregory Dean Fields	Harrisburg
*Stephanie Kaye Fields	Raleigh
Phillip Anthony Fisher	Weaverville
*Paul Louis Fitch	Waynesville
William Cullen Fox	Charlotte

†Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

Eric Rudolph Frazier	High Point
†**Dennis Eugene Freeland	Raleigh
David Arthur Gaines	Goldston
**Mark Lewis Grabb	Fairfax, VA
***David Stephen Griswold	Durham
**Michael Hilarion Gulyn	Salisbury
*David Harrison Hammer	Greensboro
George Russell Hardin	Havelock
James Fitzgerald Harris	Hyattsville, MD
John Franklin Hawkins	Raleigh
Dawn Michelle Haywood	Raleigh
Michael Louis Hooks	Winston-Salem
Attila Barnabas Horvath	Raleigh
†James Lee House	Pinetops
Samuel Warren Howell	New Bern
Hans Harward Hutchins	Raleigh
Javed Iqbal	Raleigh
David Charles Jarman	Jacksonville
**Julius John Jaskot, Jr.	Orlando, FL
Eric Gerald Jedd	Hendersonville
Charles Willie Johnson, Jr.	Eden
David Phillip Johnson	Raleigh
Jeffrey Gilchrist Johnson	Lillington
Nita Charlene Johnson	Raleigh
†***Christopher Howard Jolly	Charlotte
Jonathan Eric Jones	Levittown, NY
John Richmond Keathley	Charleston, SC
Richard Martin Keesler	Matthews
Daniel Franklin Kidd	Rocky Mount
Robert Youngsoo Kim	Greensboro
Sang Chun Kim	Burlington
**Robert Alan Koch	Asheville
***Henry David Kuo	Lumberton
Linda Janette Kushner	High Point
**Charles Dwight Lane	McLeansville
Arthur Louis Lanni	Cinnaminson, NJ
Nancy Christine Leverage	Vienna, VA
*Craig Robert Lewis	Wilson
Phillip Lamaris Locklear	Pembroke
Brett Louis	Garner
Alan Edward Lyon	State Road
Vernon Roderick Malone	Raleigh
Woods Jackson Martin	Lowell
**David George Matthews	Raleigh
Rebecca Lynn McBride	Gastonia
Todd Andrews McBride	Tarboro
Jeffrey Dale McCullough	Mocksville
Kenneth Ray McNeill	Sanford
Steven Robert Medeiros	Raleigh
Michelle Mary Melvin	Durham
Derrick Clint Misenheimer	Randleman
Kelvin Christian Mitchell	North Wilkesboro
Anthony Hughes Morris	Chapel Hill
Gregory Scott Morton	Mooreville
Frankie Lee Musselwhite, Jr.	China Grove
Michael Jerry Nester	Mount Airy
†Mark Anderson Newton	Charlotte

Hung Si Nguyen	Raleigh
Jerry William Oakley, Jr.	Fayetteville
Edward Shannon O'Neal	Raleigh
Madan Shantilal Patel	Roanoke Rapids
William Henry Peebles, Jr.	Raleigh
Burt Franklin Peoples	Louisburg
Thomas Nathaniel Poole	Robbins
***Mark Glenn Powell	Ellenboro
Jeffrey Caryl Prim	East Bend
Joseph Len Puckett	Hamlet
*Brian Earle Purvis	Bennett
James Earl Ridgeway	Lenoir
Henry Jackson Ritchie, Jr.	Concord
Craig Lee Robinson	Gastonia
Jerel Howard Ross	Merritt Island, FL
John Bowen Ross, III	Upper Saddle River, NJ
Scott Guthrie Rudolph	Kernersville
Michael Alexander Rutchka	Charlotte
James Lee Sanders, III	Raleigh
*Grant Josef Schmidtko	Fayetteville
David James Schmitt	High Point
**Ray Michael Sebastian	North Wilkesboro
Ishan Tosh Sehgal	Greenville
*William Emmett Sharp	Greensboro
**Gary Milton Shearin	Louisburg
Phillip Carlton Shepard	Wilson
Christian Craig Simonsen	Rocky Mount
Corey Barton Sims	Asheville
*Janet Lynn Steadman	Raleigh
James Robert Stritzinger, Jr.	Newark, DE
***John Robert Studders	Greensboro
**John Dongbin Suh	Greensboro
William Bryan Sykes	Greensboro
**Thomas Lee Tapp	Efland
**Timothy Michael Taylor	Charlotte
**William Raymond Thompson	Charlotte
†Mark McCoy Thompson-Bullock	Durham
***Lambros John Toumaras	Greensboro
Ha Ngoc Tran	Raleigh
Kristine Rita Troutner	Rockville, MD
Ronald Lee Vaden	Westfield
Andreas Walter Walsh	Fayetteville
*Ronald William Waltman, Jr.	Durham
Daniel Wrey Watkins	Raleigh
Jeffrey Mark Weingarten	Pittsburgh, PA
Daniel Edward Wessell	Hillsborough
†***Gregory Stuart Whitcomb	Raleigh
***Keith Jordan White	Charlotte
Chet Lassiter Whitley	Havelock
William Matthew Woodward	Jacksonville

BACHELOR OF SCIENCE IN ENGINEERING OPERATIONS

Degrees Conferred June 27, 1985

Laura Jane Huth	Charlotte
John Bradley Kight	Jacksonville

Degrees Conferred August 8, 1985

Georgina Lei Glenn	Charlotte
David Theodore Huth	Mint Hill

Degrees Conferred December 17, 1985

Mary Dixie Owensby	Fayetteville
Steven Gerard Steigerwald	Raleigh
Rex Walker Williams	Raleigh
Philip Ray Wong	Statesville

Degrees Conferred May 10, 1986

Kimberly Anne Adcock	Raleigh
David William Clemmer	High Point
Eric Starr Dotson	Lenoir
Timothy Marriott Draper	Raleigh
†James Lee House	Pinetops
Wesley Mack Kerley	Hiddenite

BACHELOR OF SCIENCE IN FURNITURE MANUFACTURING AND MANAGEMENT

Degree Conferred August 8, 1985

David William Maxwell	Raleigh
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Degrees Conferred December 17, 1985

Curtis Ward Martin	Greensboro
Joseph Francis Moran	Raleigh
Gregory Kevin Parham	Hendersonville
Scott Lee Propst	Hickory
Glendel Leon Tucker, Jr.	Grifton
James Lee Underwood	Norwood
Christopher Lewis Warren	Spruce Pine

Degrees Conferred May 10, 1986

†James Edward Kennedy	Raleigh
***David Stephen Miller	Buffalo, NY
David Hagen Norcom	Sophia
Mark Allison Perkins	Pilot Mountain

BACHELOR OF SCIENCE IN INDUSTRIAL ENGINEERING

Degrees Conferred June 27, 1985

Ronald Clifford Miller	Winston-Salem
†Michael Troy Summerlin	Kenansville
Belinda Diane Wells	Chapel Hill
Jeffrey Thomas Wolinski	Raleigh

Degrees Conferred August 8, 1985

Kimberly Miles Dula	Lenoir
Maureen Anne Goberni	Chambersburg, PA
Laura Elizabeth Lowdermilk	Morganton
Susan Renee Milton	Franklinton
John Timothy Pazdan	Greenville, SC
Bobby Kent Potts, Jr.	High Point

Charles Frederick Wegman, Jr.	Greensboro
Jean Lynnette Williams	Enfield

Degrees Conferred December 17, 1985

**Nancy Suzanne Adams	Raleigh
Frank Hay Alexander	Charlotte
Michael Gordon Aycock	Goldsboro
Sara Eve Baker	Greenville
***Debra Newell Berry	Mooreville
Sarah Alison Bethune	Charlotte
Vander Earl Brogden, Jr.	Graham
Troy Wayne Byars	Mooreboro
Thomas Edward Carter, Jr.	Clayton
William Allen Conger, Jr.	Raleigh
Andrew Mason Cumpston	Havelock
David James Davis	Raleigh
*Robert Peter Davis	Raleigh
Brian David Fulbright	Charlotte
Lori Ruth Granger	Maiden
Lisa Kaye Grippio	Raleigh
Steven Douglas Hepler	Lewisville
Eric Anthony Jackson	Chicago, IL
Nancy Kay Kehr	Atlanta, GA
†Michael Reid Langdon	Fayetteville
Marilyn Gail Lee	Garner
Karen Denise LeFevers	Hudson
Pauline Marilyn Leveille	Raleigh
Brent Neron Long	Chapel Hill
Robert Bruce McCrickard	Cary
Robert Joseph Mitchell	Endicott, NY
Steve King Monteith	Raleigh
*Mark Timothy Moore	Walnut Cove
Don Munk	Raleigh
*Robert Arthur Murray	Fayetteville
Vicki Carol Odom	Fayetteville
Todd Austin Pickard	Greensboro
Tammy Renee Routh	Asheboro
Ricky Samuel Steed	Fuquay-Varina
Mark Edward Trail	Norwood
Thomas Leo Tweedlie	Goldsboro
William Wallace Walker	Summerfield
William Mitchell Whitlow	Sharon, SC
Gregory Wayne Williams	Burlington
Todd Gregory Woodard	Graham
Rachel Ann Wright	Raleigh
Barbara Lynn Yopp	Winston-Salem

Degrees Conferred May 10, 1986

Sarah Lynne Ash	Jacksonville
David Wayne Baker	Creedmoor
Catherine Rose Barefoot	Greensboro
Mark Louis Barrier	Concord
Diane Lynn Bartz	Wake Forest
David Ray Bennett	Thomasville
Leslie Karen Brown	Greensboro
Jeffrey Lynn Bryant	Townville, PA
Randolph Craig Bryant	Hope Mills

†Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

**Yvonne Michelle Bunn	Bath
Thomas Foster Champbell	Mocksville
Emaline Anne Canada	Raleigh
Susan Maria Capell	Winston-Salem
Constance Eugenia Clement	Mocksville
John James Curtis	Winston-Salem
Michelle Felecia Davis	Rocky Mount
Lynne Lenore Dobbins	Statesville
Timothy Edwin Drew	Macclesfield
*Diane Fairlie	Warren, MI
*Ricky Dean Fisher	Newton
Clyde Dwayne Flynt	Kernersville
Melvin Tracy Freeman	Lake Waccamaw
Scott Lee Gardner	Greensboro
*Nancy Patricia Greene	Clemmons
Donald Ray Griffin	Winston-Salem
Jack Thomas Harris	Durham
Joy Montine Hazen	Coral Gables, FL
Veronica McLaurin Hedges	Fayetteville
Steven Barry Helms	Midland
Lonnie Gene Hensley	Candler
Garland Kermit Hilliard, III	Raleigh
Gregory Andrew Hills	Cato, NY
Randi Lynnette Horning	Charlotte
Jan Blair Hughes	Asheville
†Daron Charles Hyatt	Monroe
Karen Jashinski	Statesville
David Scott Johnson	Thomasville
Lisa Ann Joyner	Southern Pines
Mary Leanne Karn	Memphis, TN
†James Edward Kennedy	Raleigh
Robert Norman Kirk	Winston-Salem
Laura Lee Kyle	Poughkeepsie, NY
**Tina René LaRose	Greensboro
Patrice Cleonette Lassiter	Charlotte
*Elizabeth Anne Mackey	Huntsville, AL
Sara Jane Mangum	Roxboro
Stephen Craig May	Kinston
Tammy Charlamagne McCrae	Durham
Joan Theresa McCuller	Belhaven
Julie Suzanne McLaughlin	Asheboro
***Penelope Ann McLean	Horse Shoe
Robert Allen Mohler	Roanoke, VA
Sharon Lynn Weers Morales	Raleigh
Harvey Clyde Nix, III	Reidsville
Anita Elaine Noles	Apex
*Blany McLawhorn Page	Burgaw
Peyton Hogue Park	Charlotte
Robert Marc Parker	Greensboro
Charles Taylor Peel, Jr.	Durham
*Martha Ellen Petree	Kernersville
Andrew Jude Plisko	Newport
***Kathleen McKinney Rau	Cary
Danny Ray Redman	Cleveland
Richard Wallace Roycroft	Durham
*Randy Steven Rutledge	Candler

Julie Ellen Schulz	Edinboro, PA
**Jennifer Ann Shea	Pittsburgh, PA
Hans Christopher Shearer	Fayetteville
Brent Wray Shive	Rockwell
Tina Marie Shope	Sanford
Samuel David Smith	Fayetteville
Todd Wayne Smith	Nashville
*Yvonne Maness Stewart	Kannapolis
Walter James Turner, Jr.	Eden
Kaoru Ann Weisenmiller	Fayetteville
*Lisa Faith Wells	Elizabeth City
Sharon Ann Whitfield	Roxboro
Michael Edward Williams	Laurinburg
*Rachel Wynne Williams	Charlotte
Stephen Travis Wilson	Wilmington
David Scott Winchip	Rochester, NY

BACHELOR OF SCIENCE IN MATERIALS ENGINEERING

Degrees Conferred December 17, 1985

Thomas Artimus Barber, III	Raleigh
**James Paul Vitarelli	Levittown, PA
*William Scott Walston	Silver Spring, MD

Degrees Conferred May 10, 1986

Douglas Edward Banks	Four Oaks
**Stuart Eric Broyles	Raleigh
Mark William Brumsey	Raleigh
Bryan Dale Burney	Fayetteville
Michael John Dalbo	Cary
*Elizabeth Anne Foster	Mocksville
Timothy Dean Holleman	Gibsonville
Thomas Stephen Christian Holmes	Fayetteville
***Jeffrey Wayne Honeycutt	Raleigh
Michael Leon Languell	Tarboro
Joe Harrington Melvin, Jr.	Fayetteville
Percil Watkins	Bunn
*Bradley Earl Williams	Wingate
Jacqueline Ann Williams	Raleigh
Rosalyn Renée Williamson	Youngsville

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

Degrees Conferred June 27, 1985

Ali Dogrusoz	Raleigh
David Andrew Eichenberger	Raleigh
Steven Michael Hailey	Richmond, VA
Bryan Russell Kohn	Franklin
John Charles Larzelere	Lynchburg, VA
**Kevin Alan MacFadden	Raleigh
Eric Scott Mintz	Andrews
Nguyen Xuan Nguyen	Raleigh
***Franklin Scott Robinson	Apex
Herbert Allen Smith, Jr.	Greensboro

Degrees Conferred August 8, 1985

Catalina Augusta Andrade	Raleigh
Joseph Taft Baysdon	Greensboro
Richard Samuel Conyers	Rocky Mount
Mark Wayland Gaither	Cary
David Franklin Helton	Lucia
Audrey Marie Hixon	Greensboro
Gregory L. Hunt	Greensboro
Richard Raymond Keil, Jr.	Raleigh
William Henry Odell	Charlottesville, VA
James Anthony O'Neil	High Point
Paul Godwin Parker, III	Tarboro
William Keith Robertson	Greensboro
Michael Wayne Smith	Morganton
*William Larry Vaught	Greensboro

Degrees Conferred December 17, 1985

Alexander Alston	Pittsboro
John VanNess Andrews	Charlotte
Peter Andrew Armstrong	High Point
†*James Edward Ashe	Winston-Salem
Mark David Bowen	Dunedin, FL
James Wooten Boykin	Goldsboro
†*Bruce Lewis Butler	Tryon
*James Craig Champion	Monroe
Marcel Choudhury	Elizabeth City
Bruce Allen Cockerham	Raleigh
James Harold Cooper	Charlotte
Grant Lyle Costa	Newport News, VA
Alan Gary Daeke	Norlina
Ninh Huu Dang	Monroe
Kishor Santilal Daya	Johannesburg, South Africa
Michael Dean Dray	Raleigh
***Joe Dean Drescher	Harrisonburg, VA
Bradford Neil Ellis	Ramseur
William Franklin Ferrell, Jr.	Garner
*Mitchell Edward Filip	Raleigh
Larry James Foster	Burlington
Joseph Michael Garibay	Burlington
Howell Monroe Gentry	Reidsville
Mitchell Albert Giulietti	Schenectady, NY
Alton Edward Grimes, III	Robersonville
Kurt Lennart Holmberg	Fairhope, AL
Max Edward Hopkins	Walnut Cove
Neil Hamlin Johnson	Wakefield, VA
*Robert Lee Josey	Charlotte
**Franz Werner Kellar	Gastonia
Michael William Kilian	Norlina
Phillip Andrew Killian	Maiden
*Mark Alan Knowles	Boca Raton, FL
Daniel Scott Knox	Greensboro
Robert Jeffrey Lane	Riegelwood
Michael Scott Lanham	Jamestown
Steven Lee Lisk	Charlotte
Robert William Long	Raleigh
Ricardo Luis López-Senati	San Juan, PR
John Calvin May	Winston-Salem
Keith Dwayne McCulloch	Burlington

†Co-major

*Cum Laude

**Magna Cum Laude

***Summa Cum Laude

H Honors Program

Timothy Ryan McElwee	Blacksburg, VA
Joseph Allen Melton	Raleigh
Mark Wade Musser	Raleigh
Danh Ngoc Nguyen	Quang Ngai, Vietnam
Fidelis Chineadu Obikwu	London, England
Bruce Douglas Powell	Cary
**Derrick Yale Promislow	Charlotte
George Washington Pullium, III	Knightdale
**Warren Ashley ReBarker	Dunn
David Charles Renegar	Winston-Salem
John David Rhodes	Germanton
*Christopher William Rowen	Summit, NJ
Christopher Settle Sharpe	Wentworth
Michael Dee Sides	Kernersville
William Marvin Smith, Jr.	Richmond, VA
Edward Jack Solomon	Brandon, VT
Kenneth Dean Stewart	Raleigh
David Gregg Surratt	Kinston
*Terry Lee Sutton	Cramerton
Michael Duane Swayze	Greenville
Charles Edwin Sykes	Charlotte
†Tuy Quoc Tran	Raleigh
Dennis James Turner	Wilmington
Robert Wesley Welborn	Greensboro
Christopher William Willes	Charlotte
***Jeffrey Edward Williams	Raleigh
Robert Barry Womack	Cumberland, MD
***David Lloyd Wood	Raleigh

Degrees Conferred May 10, 1986

*Andrew Wilson Adams, Jr.	Hickory
Ronald James Agar	Lynchburg, VA
James Franklin Anderson, Jr.	Wilmington
Paul Sellars Atlas	Asheboro
Randy Eugene Bennett	Rural Hall
Rhonda Fay Blanks	East Arcadia
Arthur Patrick Bowling	Raleigh
**William Frederick Brooks	Fairview
**Philip Randall Brown, II	Asheboro
Janet Marie Bullock	Vincentown, NJ
Pamala Kay Cabaniss	Shelby
Paul Doncan Campbell	Monroe
Martin Van Capps	Burlington
*Kevin Franklin Casey	Goldsboro
Tracy Neil Coffey	Forest City
Gregory Scott Cogdill	Waynesville
Brett Alan Colby	Morehead City
Harold Lloyd Crowder, Jr.	Kannapolis
Derek Sprouse Cudd	Greensboro
Kenneth Lee Culver	Salisbury, MD
Jesse Frank Day	Burlington
*Richard Wagner Deese	Conover
**Jeffrey Mark Donaldson	Charlotte
**Ashley Liston Dunn, Jr.	Arden
***AnaRita Weber Eason	Greenville
William David Etherington	Pennington, NJ
Jeffrey Stuart Everett	Washington
Douglas Hart Fairfield	Greensboro

†Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

Andrew Jackson Fowler, Jr.	Monroe
Henry Thomas Foxx	Siler City
Christopher Robert Fulp	Winston-Salem
David Michael Graves	Charlotte
***Jeffrey Linn Griffith	Newell
John David Grimm	Carthage
**Harvey Leon Guffey, Jr.	Ellenboro
Donald Wayne Hamilton	Millspring
**Robert Alan Haughton	Wilmington
*Richard Lynn Heavner	Rockingham
Michael Floyd Hedgecock	Thomasville
*Lee Arthur Hentz	Raleigh
**Robert Beverley Herbert	Raleigh
Jeffrey Thomas Hill	Kinston
Roy Clifton Holder	Liberty
Gregory Franklin Holland	Raleigh
Daniel Baxter Huffman, II	Hickory
***Jesse Eugene Huntley, II	Forest City
Andrew Victor Jasaitis	Fayetteville
Patrick Long Jennings	Roxboro
**David Ray Jobe	Greensboro
Ricky Lee Johnson	High Point
Bron Derek Johnston	Matthews
James Frederick Jones, Jr.	Roanoke Rapids
Esther Marie King	Durham
Kieth Edward Knoll	Jamestown
*Jimmy Edward Lail	Connelly Springs
***Russell Gregory Lambert	Mars Hill
***Daniel Philmon Lawing	Lincolnton
David William Lazzo	Raleigh
Todd Alan Leatherman	Newton
John William LeFevre, II	North Rose, NY
Stephen Dean Lowry	Pembroke
James David Lyons	Tarboro
John Carey McCachern	Winston-Salem
Stephen Frank McGovern	Raleigh
Charles Alan McKeel	Princeton
*Michael James Mehaffey	Maggie Valley
**David Wesley Monteith	Huntersville
Gina Lori Morton	Salisbury
Keith Claxton Moye	Greensboro
*Sey Sehwan Nam	Fayetteville
***Scott Radley Needham	Concord
**Richard Maurice Neville	Yorktown, VA
Ramona Lisa Noriega	Pembroke
Bradford Davis Old	Wilmington
Lee Ann Olson	Eden
James Anthony Palmer	King
Jason Edward Parrott	Allentown, PA
***Bryan Dwight Payne	Greensboro
William Taylor Payne, III	Asheville
James Alexander Peele	Williamston
James Raymond Penland	Hayesville
*Steve Russell Proctor	Nashville
Mitchael Craig Rosenberg	Marlboro, NJ
Charles Edward Schulz, Jr.	Raleigh
Randy Hawley Sellet	Chapel Hill

James Mark Shaw	Lillington
Tony Herman Shaw, Jr.	Fayetteville
Alan David Shiffman	Philadelphia, PA
*John Robert Shuler	Gastonia
James Edward Smith, Jr.	Concord
David Lee Stackhouse	Siler City
Thomas Stuart Stapleford	Raleigh
Robert Spencer Stokes	New Bern
Kerry Michael Sullivan	Cary
Shahriar Taj-Taraghi	Raleigh
*Frank Treavis Taylor	Merry Hill
Robby Morton Taylor	Harkers Island
Jeffrey Scott Tillack	Johnsonburg, PA
James Purdin Tittrington	Willow Springs
Mark Alan Vanhoy	Hamptonville
Todd Everette Vick	Fayetteville
*John Ramon Viego	Wilmington
Sandra Lee Walker	Bernardsville, NJ
Raymond Mark Walton	Wilmington
Norman Bruce Warren	Durham
Allison Elizabeth Weeks	Raleigh
Roger Lewis Weeks	Chesterfield, VA
*Douglas Hobert Welch	Charlotte
John Bryan White	Salemburg
Raymond Thomas Williams	Woodbridge, VA
David Edward Wright	Asheboro
Ralph William Wyndrum, III	Basking Ridge, NJ
Charles Frank Yirka	Raleigh
Perry Alexander Young	Goldsboro
George Michael Zalaquett	Monroe

BACHELOR OF SCIENCE IN NUCLEAR ENGINEERING

Degree Conferred August 8, 1985

Randolph Andrew Houck	Raleigh
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Degrees Conferred May 10, 1986

Glenn Anthony Christenbury	Charlotte
William Dale Clark, Jr.	Hickory
†Laric Eugene Copes	Beaufort
*William Ray Doggett	Cary
Linda Carla Hipp	Raleigh
***Alan Scott Icenhour	Lenoir
Ted Russell Myers	Thomasville
**Keyes Arthur Niemer	Charlotte
Phillip Douglas Paul, Jr.	Wadesboro
James Donald Pierce	Wilmington
Mark Alan Pinkston	Waynesville
Charles Woodrow Smith, III	Charlotte
*Eric Shelton Snider	Madison
***Joseph Ben Stroup	Cherryville
**Todd Lewis Wilson	Durham
Issa Jack Zarzar	Raleigh
John Frederick Zino	East Northport, NY

†Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

School of Forest Resources



BACHELOR OF SCIENCE IN CONSERVATION

Jointly administered by the School of Forest Resources and the School of Agriculture and Life Sciences.

Degree Conferred May 10, 1986

John Lewis White Halifax

BACHELOR OF SCIENCE IN FORESTRY

Degree Conferred June 27, 1985

Jeffory Keith Barton Cary

Degrees Conferred August 8, 1985

Sam Cooke, Jr. Raleigh
 **Marcus Allen Hair, II Fayetteville
 Mark Wayne Meyer Greenville
 *Jonathan Scott Reynik Haddonfield, NJ

Degrees Conferred December 17, 1985

Rhonda Kelli Blackwelder Statesville
 Thomas Andrew Dietrich Garner
 Alan Wayne Emmons Browns Mills, NJ
 Brian Anthony Goodin Winston-Salem
 Terry Dale Holdsclaw Mooresville
 Donald Lynn Jenkins Potecasi
 John Anthony Mebane Mebane
 Ronald Wayne Phillips Wilmington
 Robert Byron Robeson Durham
 James Ernest Robinson Salisbury
 Jeffrey Troy Sawyers Pineville
 Edward Ray Swan Mount Gilead

Degrees Conferred May 10, 1986

Ivan Norris Braswell Princeton
 William Roy Cloninger Bessemer City
 John Hart Crowder, III Raleigh
 David Warren Fogarty Hickory
 Audrey Gail Hockaday Roanoke Rapids
 Michael Allen Huster Westerville, OH
 *Amy Kathryn Kluttz Mount Pleasant
 Cedric Locklear Lumberton
 Michael Thomas O'Neill Havelock
 Michael Scott Owens Gastonia
 Tracy Ivey Parrish Elizabethtown
 Jorge Jose Pericchi Caracas, Venezuela
 Robert Todd Smith Burlington
 Roger Derl Stallard Maggie Valley
 Gwyn Olivia Trueblood Hertford

†Co-major

*Cum Laude

**Magna Cum Laude

***Summa Cum Laude

H Honors Program

***Nancy Lynne Turpen	Beachwood, NJ
Thomas Edward White	New Bern
Edward James Williams	Fayetteville

BACHELOR OF SCIENCE IN PULP AND PAPER SCIENCE AND TECHNOLOGY

Degrees Conferred June 27, 1985

Charles Henry Cleveland	Satsuma, AL
Tommy Dean Riddle	Waynesville
Charles Allen Sanders	Raleigh

Degrees Conferred December 17, 1985

†Richard Byrd Barnes	Wilmington
†Roy Arston Grant	Stone Mountain, GA
Eric Howell	Statesville
Michael Bernard Jackson	Hartsville, SC
David Hembree Milner	Waynesville
†Gary John Steiger	Pensacola, FL
Richard Roy Turner	Saint Simons Island, GA
John Bennett West, Jr.	Warsaw

Degrees Conferred May 10, 1986

William Peter Bailey	Como
***Robert Chancy Blohm	Atlanta, GA
Galen Francis Butler	Matoaca, VA
Brent Alan Carpenter	Atlanta, GA
Robert Samuel Cobb, Jr.	Drewryville, VA
†John Eyster Garnett	Greenwich, CT
Clinton Douglas Hester	Kernersville
H*David Cary Holt	Charlotte
John London Jerome, Jr.	Cooleemee
Janis Marie Johnson	Decatur, IL
Jeffrey Talbot Joyce	Richmond, VA
Rebecca Neale Lindsey	Richmond, VA
Marianne Clark Rhodes	Lynchburg, VA
†*Jennifer Ann Scott	Augusta, GA
Brian Robert Szafranski	Hopewell, VA
Jeffrey Mark Vermilyea	Boxford, MA
Tom William Wadsworth	Newtown Square, PA
†Everett Grady Wetherington	La Grange
Gregory Alan Williams	Thomasville

BACHELOR OF SCIENCE IN RECREATION RESOURCES ADMINISTRATION

Degrees Conferred June 27, 1985

H**Patrick Robert Enniss	Statesville
Gary Maurice Whiteside	Fletcher

Degrees Conferred August 8, 1985

William House Dove, II	Rocky Mount
Mark Keen Grainger	Clarkton
Jennifer Rita Ladner	Lancaster, PA
Ruth Ann Whetstone	Shelby

Degrees Conferred December 17, 1985

Anthony James Baker	Brisbane, Australia
Audrey Kathryn Brown	Fayetteville
Kim Michelle Bryant	Fayetteville
Scott William Cornelius	Raleigh
Criston Calvin Cowan	Detroit, MI
*Perry Martene Daum	Woodbury, NY
Angela Karen Fellers	Fayetteville
Laurie Beth Hagen	Parkesburg, PA
Tina Ann Hardee	Whiteville
Luther Ellis Ledford, III	Pink Hill
Suzanne Catherine Meese	Raleigh
Lori Ann Morrison	Greensboro
William Wesley Poplin	Ronda
Amy Blake Satterfield	Charlotte
†Suzanne Gail Saunders	Troy
David Alan Saxe	North Conway, NH
*Lori Ann Zuersher	Winston-Salem

Degrees Conferred May 10, 1986

Jimmy Bruce Adams	Angier
Richard Darin Atwell	Cornelius
Andy Curtis Brannan	Zebulon
Melinda Beth Cowley	Cary
Joe Garner Creech, Jr.	Garner
Darryl Wayne Cregger	Winston-Salem
Janet Fay Derr	Lincolnton
Catherine Adkins Freeman	Concord
Elizabeth Rodgers Gessner	Raleigh
Janet Elissa Guley	Matthews
Laura Jean Kennaugh	Huntington, NY
Steven Harry Lewis	New Haven, CT
Linda Jean Maynard	Graham
George Wilds McClure	Mooresville
Jeffrey Lynn Moss	Kings Mountain
Brant Alan Norris	East Spencer
Wendy Denise Parker	Pfafftown
Bradley Miles Pierce	North Canton, CT
Ricky Lynn Poplin	Concord
Lisa Lynn Shumate	Salisbury
John Boyce Styron	Marion, VA
Cynthia Leigh Summer	Cherryville
Jennie Lisabeth Wade	Thomasville

BACHELOR OF SCIENCE IN WOOD SCIENCE AND TECHNOLOGY

Degrees Conferred May 10, 1986

Annette Fisher Augustine	Fairhaven, MA
Craig Armstrong Ferry	Grosse Ile, MI
Joseph Harold Heard, Jr.	Greensboro
Sheila Yvonne Johnson	Garysburg
Charles Neill O'Quinn, Jr.	Kingstree, SC
**Joseph Timothy Roberts	Asheville
Tracy Gray Speas	Tobaccoville
Miles Glenn Swink	Roanoke Rapids

†Co-major

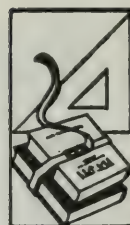
* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

School of Humanities and Social Sciences



BACHELOR OF ARTS IN ACCOUNTING

Degrees Conferred June 27, 1985

Deborah Page Burgess	Hendersonville
Veronica Lynnette Floyd	Turkey
Antoinette Hrabanek Holloman	Charlotte
†Shellie Ann Howell	Franklin
Abby Lynn Parvin	Goldsboro
Mary Bee Wilson	Newton Grove

Degrees Conferred August 8, 1985

Brian Curtis Baker	Chapel Hill
Nora Hui	Cary
Scott Howell May	Spring Hope
Edward Andy Meredith, Jr.	Burlington
Sandra Lee Mouton	Fayetteville
Angela Kay Poteat	Greensboro

Degrees Conferred December 17, 1985

*Paul Glenn Bailey	Lexington
*Larry Dean Boykin	Wilson
**Gregory Hampton Briley	Goldsboro
Christopher Alan Cashman	Hollywood, FL
Cynthia Ellen Cheek	Chapel Hill
Susan Faye Currin	Oxford
Trellace Hunt Ellington	Wilmington
*Genevieve Garrou Exum	Fayetteville
Betsy Deanna Gentry	Winston-Salem
†Linda Sue Grant	Elizabeth City
Gregory Marshall Harris	Plymouth
Jeanette Elizabeth Hatley	Cary
**Linda Petrie Haywood	Benson
George Wall Holden, III	Henderson
Nancy Huang	Cary
Lana Renee Jenkins	College Park, MD
Carl Lee Keatts, Jr.	Durham
Clara Melissa Lisk	Burlington
Michelle Marie Marrocco	McLean, VA
Gregory Bernard McCraw	Spindale
Michael Richard McKenna	Huntington, NY
†Stephen Paul Mitchell	Goldsboro
*Kelly Denise Moore	Charlotte
James William Nowoswiat	Boonton, NJ
Anne Elizabeth Olds	Cary
Mary Carlyn O'Neill	Cockeysville, MD
Gregory Terris Redman	Lillington

†Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

†Carroll Lynn Russ	Greensboro
Steven Wallace Sawyer	Plymouth
*Chandrika Mahendra Shrimanker	Bombay, India
Melanie Manning Simpson	Windsor
Laurie Price Smith	Raleigh
†Lynn Allison Smith	West End
†Myra Ellene Stocker	Kenansville
†Robert Walton Swinson	Garner
Carla Beth Taylor	Yadkinville
Kenneth Ray Taylor, Jr.	Rocky Mount
Sylvia Lynne Thornton	Clayton
**Jean Marie Walder	Lynchburg, VA
Joi Lucas Ward	Asheboro
Michael O'Neal Warren	Raleigh
†Diane Elizabeth Wortmann	Carle Place, NY
Reuben Franklin York, Jr.	Lillington
*Richard Edward Yorkovich	Charlotte

Degrees Conferred May 10, 1986

Naveed Ahmed	Karachi, Pakistan
†Jeffrey Charles Autry	Fayetteville
Ellen Elizabeth Barnes	Durham
*Sandra Mae Beam	Shelby
Deirdre Celeste Becoat	Raleigh
Darrell Craig Brown	Winterville
Hoyt Wayne Burgess	Ramseur
Jeffrey Leonard Byrd	Fayetteville
Walker Laughlin Casey	Raleigh
James Malcolm Cholerton	Garner
Marvin Cashius Cluff	High Point
Ersdeen Cogdell, Jr.	Goldsboro
†Steven Edward Crouse	Winston-Salem
†Mary-Ellen Theresa Daly	Silver Spring, MD
Carl Eugene Deckard	Raleigh
Kelly Dean Denton	Raleigh
John William Epps	Wayne, PA
Leah Leigh Falls	Bessemer City
James Michael Frye	Richmond, VA
Pamela Jean Gallagher	Raleigh
Margaret Elizabeth Gant	Potomac, MD
Harold Glenn Garrett	South Boston, VA
Charles Edward Garrison	Greensboro
Michael Andrew Gentry	Virginia Beach, VA
†Kimberly Dawn Greene	Oxford
Andrew Joseph Griner	Raleigh
**Karen Kearney Gupton	Franklinton
Laura Beth Gupton	Wilson
Richard Mark Hager	Huntersville
Marsha Carol Harris	Raleigh
Mary Nell Hassell	Roper
**Anita Sue Heavner	Henderson
†Alphonso Hinton	Pinetops
Paul Lawrence Holland	Garner
Diane Lynn Hubatka	Cary
Gary James Jaluvka	Raleigh

†Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

***Marilyn Morgan Jarriel	Aiken, SC
Kimberly Carter Johnson	Asheville
Kimberly Denise Johnson	Rockingham
*Bobby Jeffrey Jones	Henderson
Tyree Lyntel Jones	Raleigh
†Barbara Jean Judge	Charlotte
Vernon Lee	Raleigh
Jeffrey Dean Leonard	Lexington
†Janet Lynn Livengood	Winston-Salem
Robert Stephen Lowther	Charleston, WV
Penny Denise Martin	Rural Hall
†Sharon Omega McDougal	Roxboro
Connie Elizabeth Medina	Gibsonville
Timothy Edward Mullis	Monroe
Katherine Elaine Newman	Fayetteville
***Lumbia Marie Reavis	Charlotte
Christopher Gray Reid	Winston-Salem
Napoleon Richardson, Jr.	Silver Spring, MD
Bonnie Sue Ricks	Durham
Kenneth Duane Scott	Garner
Linda Kaye Smith	Raleigh
Sharon Gale Smith	Thomasville
Teresa Jean Smith	Cary
†Rodger Rees Stephens	Annapolis, MD
Douglas Robert Still	Cary
William Wilson Stokes	Wilmington
Melanie Hope Streeter	Greenville
Michael Francis Sullivan	Fayetteville
Rodney Lee Thomas	Fayetteville
Teresa Michele Thomas	Nags Head
Diane Rebecca Thompson	Charlotte
Kent Covington Thompson	Thomasville
†Sheila Lynn Todd	Raleigh
***Karen Denise Torrence	Raleigh
Janice Faye Tripp	Raleigh
Diane Faulhaber Tubbs	South Bend, IN
Sandra Nicole Underwood	Asheboro
Terri Melisa Warren	Faison
Robin Suzette White	Greensboro
Jeffrey Alan Wiblitzhouser	Raleigh
Nancy Percosky Willoughby	Henderson
Calvin Jerome Wilson	Zebulon
Jeffrey Kevin Younce	High Point

BACHELOR OF ARTS IN BUSINESS MANAGEMENT

Degrees Conferred June 27, 1985

†John Bakty Barber	Lenoir City, TN
Katherine Lynne Barnes	Wilson
Lonnie Stubbs Brock, III	Rae ford
†Terrie Denise Carter	Garner
George Lennon Clark, III	Clarkton
†Peter George Currence	Gastonia
Brian Quentin Darling	Raleigh
Nydia Lee Doggett	Raleigh

†Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

Frederick Keith Duffer	Charlotte
Kevin Patrick Duffy	Raleigh
†Jeffrey Lewis Dunlea	Wilmington
Carla Elizabeth Evans	Raleigh
Mark Stephen Fernandes	Newark, DE
†David McQueen Fitchett	Dunn
†Dean Sheppard Hand	Camden
***Melinda Jones Hogan	Raleigh
Robert Nelson Holland	Cary
Jamie McKinnon Horton	Newark, NJ
†Shellie Ann Howell	Franklin
†**James Joseph Humphrey	Raleigh
Dean Ellis Lackey	Newton
†Richard Craig Layman	Louisville, KY
Mark Benedict Leonard	Raleigh
Wayne Lee Littrell	Rocky Mount
William Fisher McBrayer	Rutherfordton
Debra Lynn Parker	Henderson
Jamie McNeil Rash	North Wilkesboro
Douglas Walter Reid	Charlotte
Thomas James Roggy	Holmdel, NJ
Martha Darlene Spivey	Clarendon
†Linda Sue Strickland	Raleigh
Dean Hodges Taylor	Garner
John Randolph Willis, Jr.	Raleigh

Degrees Conferred August 8, 1985

Vincent Keith Alexander	Jonesville
Jill Victoria Britton	Charlotte
†James Floyd Byrd	Fayetteville
Paul Robert Caruolo	Minneapolis, MN
Pamela Dawn Dukes	Albany, NY
†Margaret Ann Edwards	Durham
†Daniel Alan Elmer	West Chester, PA
Bob Wayne Flintoff	Oshawa, Ontario
Jerry Patrick Gaines	Charlotte
James Richard Hannahs, Jr.	Statesville
Roger Dale Hoots	Yadkinville
Kimberly LaDrina Hunt	Roxboro
†Saleh Kamal Ibrahim	Raleigh
Iris Cassandra Jackson	Fayetteville
†Cathy Charlene Johnson	Coats
†Gregory Stavros Karagiorgis	Winston-Salem
Kimberly Michelle Kuhens	Fayetteville
William Park Lathrop	Chapel Hill
Donna Allison Lee	Charlotte
Thomas Wayne Logan, Jr.	Black Mountain
†Kenneth James Loney	Portsmouth, VA
Sandra Lovely	Philadelphia, PA
†Kelly Denise Maddry	Chapel Hill
†Bruce Thomas Marshburn	New Bern
†Deborah Anne Mason	Lillington
Deborah Eileen McGuire	Washington, DC
†Susan Lynn McNeil	Raleigh
Eric Oliver Miller	Wilmington, DE
Jay Robert Miller	Moscow, ID
Michael Alden Morrison	Clarkville, VA
Cynthia Lynn Moser	Raleigh

†Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

*Carolyn Denise Pharr	Statesville
†Tracey Elizabeth Phillips	Raleigh
†Mark Thomas Rudd	Colonial Heights, VA
†Isabel Maria Santo-Tomás	Raleigh
†Collette Leah Smith	Concord
†Lincoln Baile Sokolski	Warren, PA
†Shaun DeLaney Stewart	Sanford
Gerald Kenneth Thompson, Jr.	Lawndale
Regina Ann Tolbert	Hudson
†Kimberly Sue Warren	Garner
Sharon Anjanette Weeks	Benson
†Deborah Wise Whitfield	Roxboro
Kathie Suzanne Whitley	Elkin
†David Arthur Wright	Tabor City

Degrees Conferred December 17, 1985

†Tammy Lynne Agnew	Raleigh
†Diane Thomas Alley	Raleigh
Martha Drake Anderson	Raleigh
†Karen Ashe	Raleigh
Joseph Raymond Balint, Jr.	Raleigh
†Evelyn Theodore Besseas	Charlotte
†Steven Jay Boykin	Wendell
Mildred Rogers Brandt	Raleigh
Julian Kent Bridges, Jr.	Shelby
Paul Anthony Brim	Greensboro
Jennifer Jo Brooks	Monroe
Virgil Kevin Burch	Fairview
Kelle Brenning Butz	Waxhaw
John Clifton Canipe	High Point
†Jay Frank Caplan	Raleigh
Shirley Elizabeth Carelli	Raleigh
Pamela Lynn Cheek	Burlington
†Arthur Warren Cielo	Raleigh
Daniel Thomas Conway	Willingboro, NJ
John Frederick Core	Raleigh
**Kendi Cady Coutant	La Porte, IN
Gilmer Allen Crawford	Mocksville
***Patricia McAlhany Dukes	Cary
Dawn Bernadeane Dunagan	Fayetteville
Edward Glenn Echerd	Denton
James Henry Edgerton	Durham
Danny Carl Evans	Robersonville
†Robert Gregory Evans	Clarkton
†Gregory Glenn Felts	Winston-Salem
†Timothy Charles Fetner	Raleigh
†James Allen Ford	Sea Girt, NJ
Kevin Barry Frazier	Henderson
Katrina Elaine Fulkerson	Raleigh
†Todd Andrew Gallitz	Raleigh
Sharon Patricia Galvin	West Des Moines, IA
†Carolyn Grant	Whitakers
†Linda Sue Grant	Elizabeth City
†Lisa Kaye Greene	Raleigh
†Jeffrey Lee Guard	Raleigh
John Littleton Gwynn	Oxford
†David Kish Hambricht	Kings Mountain
†Emily Frances Harrell	Raleigh

†Spencer Louis Harrell, Jr.	Oak City
Dane Mark Hartman	Kernersville
†Richard Neil Hauser	Clemmons
†Noriko Watanabe Hawk	Raleigh
†Louis Joseph Heffner, III	Sharpsburg
Neil T. Hennes	Charlotte
**Margaret Anne Kerley Herbert	Raleigh
†Sue Royal Hill	Clarkton
Mary Frazelle Howington	Raleigh
†William Michael Hunter	Greensboro
Kimberly Carter Johnson	Asheville
Charles Allen Keeley	Greensboro
Sabrina Suzanne Lambeth	Winston-Salem
Stephen Kent Lay	Elkin
†Thomas Earl Lee	Wendell
James George Loizos	Ocean Township, NJ
Martha Ann Marley	Asheboro
James Bradford McDonald	Lillington
Timothy Stewart Means	Kernersville
†Stephen Paul Mitchell	Goldsboro
Monique Monger	Fayetteville
Richard Lawson Oldenburg	Chapel Hill
William John Oncea	Burlington
†Leigh Ann Phillips	Concord
†Thomas Jeffrey Pinyoun	Raleigh
†Cecil Ross Poole, III	Wilmington
†James Fitz Randolph	Linville
†Mark Stuart Ray	Shelby
†**Henry William Reges, II	Raleigh
†**Gregory Lynn Reynolds	Kannapolis
David Folsom Rice, III	Raleigh
†Karen Lorraine Richards	Raleigh
Cindy Leigh Robinson	Gastonia
†Benjamin Craig Rogers	Pink Hill
Melody Hope Rowley	Wendell
†Carroll Lynn Russ	Greensboro
†Marcus Alexander Sass	Fayetteville
Robert James Selden, Jr.	Monroe
†Jennifer Leigh Shelton	Winston-Salem
Franklin Todd Simpson	Monroe
†Lynn Allison Smith	West End
James Scott Spencer	Winston-Salem
Jonathan Blaine Stainback	Greensboro
†James Kipland Stallings	Oxford
†Myra Ellene Stocker	Kenansville
†Robert Walton Swinson	Garner
†Mark Steven Talbert	Albemarle
†Robin Elizabeth Teachey	Wallace
Myra Kay Tedder	Fairmont
Benjamin Stuart Terry	Raleigh
Sandra Kay Tjebben	Raleigh
David Craig Turner	Fayetteville
Kelly Renée Turner	Winston-Salem
Jeffrey Bill Vinesett	Durham
†David Scott Walker	Garner
†Sharon Elizabeth Whitehurst	Nashville
Dereck Cornelius Whittenburg	Washington, DC
Terrell Dean Wilson	Charlotte

†Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

†Walter Hugh Wilson, IV	Winston-Salem
†William Henry Wilson	Graham
†Diane Elizabeth Wortmann	Carle Place, NY
†Richard Henry Youngblood, III	Richmond, VA
†Kevin Neal Yount	Conover

Degrees Conferred May 10, 1986

Elizabeth Mariko Abe	Greensboro
Amy Elizabeth Adcock	Durham
*Thomas Ethan Allen	Morganton
**Wistar Scott Allen	High Point
Billy Eugene Anderson	Harlan, KY
Robert Joseph Arminio	Ossining, NY
†Barbara Jean Ashford	Wilson
†Margaret Jane Atkins	Raleigh
Kenneth James Atkinson	Fayetteville
*Todd Steven Austin	Raleigh
†Jeffrey Charles Autry	Fayetteville
†Kimberly Lynne Averette	Durham
*Mark Eliot Bachstein	Lenoir
Willette Bell	Goldsboro
†John Robert Bender, III	High Point
Deborah Ann Bensley	Cary
Brian Scott Bokor	Chicago, IL
Ronald Earley Boney	Rose Hill
Micahel Tyronne Boone	Garland
†Bruce Allen Bowman	Durham
†**Susan Wake Brigham	West Windsor, NJ
*Lisa Pearl Britt	Wilmington
Michael Franklin Brown	Raleigh
Thomas Tyson Bullock	Durham
†Joyce Annette Bunn	Raleigh
†Scot David Burris	Clemmons
Penelope Jill Burton	Norlina
James Robert Bush, Jr.	Raleigh
James Michael Butler	Bladenboro
†Russell Thomas Carpenter	Cary
Eileen Marie Chambers	Jacksonville
†Tracey Leigh Chapin	Matthews
*Daniel Paul Claytor	Raleigh
Dorothy Carolyn Clement	Roanoke, VA
†Douglas Jonathan Cohen	Charlotte
†Denice Evelyn Collins	Garner
†*John David Colvard	Raleigh
Julia Lasater Cooper	Raleigh
Gregory Stephen Cox	Birmingham, AL
†Steven Edward Crouse	Winston-Salem
†Mary-Ellen Theresa Daly	Silver Spring, MD
Marcus Edgar Dameron	Burlington
†Johnny Roy Davis	Randleman
Luther William Davis, II	Yadkinville
Bruce Graham Dennis	Charlotte
†Robert Alexander Diemel	Wilmington
Leonard Dale DuChaine	Jacksonville
†Dianne Louise Edris	Raleigh
†David Dale Elmore	Atlanta, GA
Ali Emran	Durham

Tamela Lynne Ennis	Raleigh
†Jon Vincent Evans	Fayetteville
†**Daniel Owen Farris	Weaverville, CA
Autrey Vann Fletcher	Gastonia
*Gregory Lenoir Forester	North Wilkesboro
Nancee Louise Franklin	Cary
†**Steven Francis Freeman	Greensboro
†Jeffrey Glenn Fuller	Raleigh
Robert Kevin Gardner	Raleigh
†Jeffrey Nelson Garrett	Elizabeth City
†Kay Marianne Glans	Miami, FL
Brian Douglas Goodwin	Raleigh
Samuel Horace Green	Fayetteville
†Kimberly Dawn Greene	Oxford
Patricia Lynn Hamilton	Marietta, GA
*Donna Sue Hardison	Jamesville
Debra Ann Harris	Jacksonville
†*Edward Dean Harris	Raleigh
†*Octavius Charles Harriss, Jr.	Salisbury
†Thomas Randolph Hartis	Kannapolis
Linda Wooten Harwell	Charlotte
Bruce Alderman Hatcher	Morganton
†Robert Gordon Haygood	Gastonia
John Edward Hemp	North Plainfield, NJ
†Robert Edward Herndon	Kings Mountain
†Alphonso Hinton	Pinetops
†Kimberly Jo Hinton	Nashville
Holly Layne Holt	Greensboro
Pamela Sue Huffman	Raleigh
†John Joseph Hummel	Saint Louis, MS
†Nancy Jo Hunt	Garner
†Laura Lynne Johnson	Rockville, MD
Susan Frances Jones	Raleigh
Valerie Lynn Jones	Brevard
†Barbara Jean Judge	Charlotte
Judith Ann Karlewicz	Oakland, NJ
†Pamela Theodore Karres	Charlotte
Robert Davis Kernodle	Burlington
†Michael Gregory Knox	Davidson
†Theodore Ernest Koehncke	Wilmington
Sandra Jean Kottcamp	Richmond, VA
Robert Charles Kuppler	Kernersville
Brent Anthony Lambert	Miami, FL
†Maria Del Pilar Law	Winston-Salem
†Douglas Mitchel Laycock	Winston-Salem
Mack Rimmer Leath	Greensboro
Ernest Keith Leonard	Marion, SC
†Janet Lynn Livengood	Winston-Salem
†Stephen Lindblad MacDonald	Durham
†Amy Ann Maddox	Fayetteville
†Xanthie Carlotta Mangum	Raleigh
†Christopher Alan Manuszak	Raleigh

Allen Bondell Martin	Four Oaks
†***William Elliott McCabe	Goldsboro
†Sharon Omega McDougal	Roxboro
†Thomas David McKernan	Charlotte
†Eric Franklin McKinney	Denton
Johnson Davis McRorie, Jr.	Sylva
Jane Gillispie Moody	Red Oak, IA
Mark Whaley Mosley	Winston-Salem
Cindy Pate Mullen	Raleigh
Cynthia Dee Murphy	Raleigh
†Kathryn Grey Murphy	Raleigh
Deborah Prince Nelms	Apex
†John King Nelms, Jr.	Oxford
Tyra Lee Newell, IV	Elizabeth City
†Christopher Luke Noto	Durham
Charles Steven Oddo	Charlotte
Nancy Jo Parham	Durham
David Anthony Parker, Jr.	Denton
†Susan Dail Parker	Raleigh
Karen Delaine Pearce	Raleigh
Patricia Renee Peterson	Shelby
†John Phillip Pettinelli	Port Washington, NY
Gordon Montroy Pettit	Charlotte
†Guido Phil Pfuhl	Charlotte
†Darryl Mack Phillips	Raleigh
David Thomas Powell, III	Richmond, VA
*†Jack Tilman Puckett	Oxford
Stuart Wayne Ramsey	Hope Mills
†Sonja Janette Ratliff	Raleigh
Jobie Gene Redmond, Jr.	High Point
Lori Ann Rinehardt	Concord
†Bradley Clayton Roberts	Henderson
†*Louis Carlton Roberts	Raleigh
†Sonja Renee Robinson	Winston-Salem
*Michelle Ann Rose	Raleigh
Glenn Alan Ruess	Raleigh
Lisa Marie Ruffieux	Rockville, MD
†*Suha Ahmad Sabi	Raleigh
†Susan Dianne Sanders	Raleigh
†Lorena Maria Segura	Tegucigalpa, Honduras
†Harvey Todd Sharpe	Burlington
Bruce Browning Shearin	Warrenton
†Karlene Marie Sheerin	Fayetteville
Thomas Newcomb Shober	Charlotte
James Harrison Simpson	Greensboro
John Louis Simpson, III	Raleigh
†Kenneth Jay Smith	Greensboro
Mark Taylor Smith	Concord, MA
David Mangles Sneed	Atlanta, GA
Lisa Courtney Lee Snyder	Greensboro
Sarah Lee Sowers	Shelby
†Andra Faith Sparks	Burnsville

Brian Craig Sparks	Rutherfordton
†Melanie Rhea Sparrow	Cary
†Lisa Kay Stanley	Tallahassee, FL
Mark Timothy Starnes	Monroe
Kathryn Denise Steinacher	Titusville, FL
†Rodger Rees Stephens	Annapolis, MD
Norwood Edward Stone	Greensboro
Eric Kermath Storey	Erie, PA
David Thomas Strader	Franklin
†Lori Ann Stuart	Teachey
†Sandra Lynne Sumner	Winston-Salem
†Gary Stokes Swann	Greensboro
Rhonda Jean Tart	Cary
William Joseph Tierney	Garden City, NY
†Sheila Lynn Todd	Raleigh
†***Jonathon Todd Trivett	Raleigh
Robert Wynne Turner	Lynchburg, VA
Timothy Scott Varnell	Macclesfield
†Hugh Carroll Vincent, III	Murfreesboro
†Steven Hughes Viola	West Jefferson
Irene Alberta Wessels	Burlington
John Ervin West, III	Matthews
†Marty Kipp Whitley	Raleigh
†Brenda Kay Whitlow	Cohasset, MA
†Gary Richard Williams	Greensboro
***David Wesley Wilson	Burlington
Mary Elizabeth Wilson	Raleigh
Virginia Merritt Yates	Raleigh
†Sheryl Lynne York	Essex Junction, VT
William Francis Zahn	Cary
George John Zardas	Moschochorion-Lamia, Greece
†Angela Robin Zimmerman	High Point

BACHELOR OF ARTS IN ECONOMICS

Degrees Conferred June 27, 1985

†John Bakty Barber	Raleigh
†Terrie Denise Carter	Garner
†Peter George Currence	Gastonia
†Jeffrey Lewis Dunlea	Wilmington
†David McQueen Fitchett	Dunn
†Dean Sheppard Hand	Camden
†**James Joseph Humphrey	Raleigh
†Richard Craig Layman	Louisville, KY
†Linda Sue Strickland	Raleigh

Degrees Conferred August 8, 1985

†James Floyd Byrd	Fayetteville
†Margaret Ann Edwards	Durham
†Daniel Alan Elmer	West Chester, PA
†Saleh Kamal Ibrahim	Raleigh
†Cathy Charlene Johnson	Coats
†Greg Stavros Karagiorgis	Winston-Salem
†Kenneth James Loney	Portsmouth, VA
†Kelly Denise Maddry	Chapel Hill

†Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

†Bruce Thomas Marshburn	New Bern
†Deborah Anne Mason	Lillington
Matt Currin Matthews	Raleigh
Jeff William McCauley	Jacksonville
†Susan Lynn McNeil	Raleigh
†Tracey Elizabeth Phillips	Raleigh
†Mark Thomas Rudd	Colonial Heights, VA
†Collette Leah Smith	Concord
†Lincoln Baile Sokolski	Warren, PA
†Shaun DeLaney Stewart	Sanford
†Kimberly Sue Warren	Garner
†Deborah Wise Whitfield	Roxboro
†David Arthur Wright	Tabor City

Degrees Conferred December 17, 1985

†Tammy Lynne Agnew	Raleigh
Kimberly Marie Andersen	Rockingham
†Karen Ashe	Raleigh
†Evelyn Theodore Besseas	Charlotte
†Steven Jay Boykin	Wendell
†Jay Frank Caplan	Raleigh
†Arthur Warren Cielo	Raleigh
†Robert Gregory Evans	Clarkton
†Gregory Glenn Felts	Winston-Salem
†Timothy Charles Fetner	Raleigh
†James Allen Ford	Sea Girt, NJ
†Todd Andrew Gallitz	Raleigh
†Carolyn Grant	Whitakers
†Lisa Kaye Greene	Raleigh
†Jeffrey Lee Guard	Raleigh
†David Kish Hambricht	Kings Mountain
†Spencer Louis Harrell, Jr.	Oak City
†Richard Neil Hauser	Clemmons
†Louis Joseph Heffner, III	Sharpsburg
†Sue Royal Hill	Clarkton
†William Michael Hunter	Greensboro
†Thomas Earl Lee	Wendell
Scott Anthony Martin	Hickory
†James Bradford McDonald	Lillington
Myra Kay Monteith	Cashiers
Carolyn Denise Pharr	Statesville
†Leigh Ann Phillips	Concord
†Thomas Jeffrey Pinyoun	Raleigh
†Cecil Ross Poole, III	Wilmington
†James Fitz Randolph	Linville
†Mark Stuart Ray	Shelby
†**Henry William Reges, II	Raleigh
†**Gregory Lynn Reynolds	Kannapolis
†David Folsom Rice	Raleigh
†Karen Lorraine Richards	Raleigh
†Benjamin Craig Rogers	Pink Hill
†Marcus Alexander Sass	Fayetteville
†Jennifer Leigh Shelton	Winston-Salem
†James Kipland Stallings	Oxford
†Mark Steven Talbert	Albemarle
†Robin Elizabeth Teachey	Wallace

†David Scott Walker	Garner
†Sharon Elizabeth Whitehurst	Nashville
†Walter Hugh Wilson, IV	Winston-Salem
†William Henry Wilson	Graham
Melody Jean Wood	Cary
†Richard Henry Youngblood, III	Richmond, VA
†Kevin Neal Yount	Conover

Degrees Conferred May 10, 1986

†Barbara Jean Ashford	Wilson
†Margaret Jane Atkins	Raleigh
†Kimberly Lynne Averette	Durham
Norman Eugene Bartholomew, Jr.	Raleigh
†John Robert Bender, III	High Point
†Bruce Allen Bowman	Durham
†**Susan Wake Brigham	West Windsor, NJ
†Joyce Annette Bunn	Raleigh
†Scot David Burris	Clemmons
†Russell Thomas Carpenter	Cary
†Tracey Leigh Chapin	Matthews
†Douglas Jonathan Cohen	Charlotte
†Denice Evelyn Collins	Garner
†*John David Colvard	Raleigh
†Johnny Roy Davis	Randleman
†Robert Alexander Diemel	Wilmington
Shawn Ambrose Dorsch	Winston-Salem
†Dianne Louise Edris	Raleigh
†David Dale Elmore	Atlanta, GA
†Jon Vincent Conrad Evans	Fayetteville
†**Steven Francis Freeman	Greensboro
†Jeffrey Glenn Fuller	Raleigh
†Jeffrey Nelson Garrett	Elizabeth City
†*Edward Dean Harris	Raleigh
†*Octavius Charles Harriss, Jr.	Salisbury
†Thomas Randolph Hartis	Kannapolis
†Robert Gordon Haygood	Gastonia
†Robert Edward Herndon	Kings Mountain
†Kimberly Jo Hinton	Nashville
†John Joseph Hummel	Saint Louis, MO
†Nancy Jo Hunt	Garner
†Laura Lynne Johnson	Rockville, MD
†Pamela Theodore Karres	Charlotte
†Michael Gregory Knox	Davidson
†Theodore Ernest Koehncke	Wilmington
†Douglas Mitchel Laycock	Winston-Salem
†Stephen Lindblad MacDonald	Durham
†Amy Ann Maddox	Fayetteville
†Xanthie Carlotta Mangum	Raleigh
†Christopher Alan Manuszak	Raleigh
†***William Elliott McCabe	Goldsboro
†Thomas David McKernan	Charlotte
†Eric Franklin McKinney	Denton
Jay Robert Miller	Deary, ID
†Kathryn Grey Murphy	Raleigh
†John King Nelms, Jr.	Oxford
†Christopher Luke Noto	Durham

†Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

†Susan Dail Parker	Raleigh
†John Phillip Pettinelli	Port Washington, NY
†Guido Phil Pfuhl	Charlotte
†Darryl Mack Phillips	Raleigh
†*Jack Tilman Puckett	Oxford
†*Sonja Janette Ratliff	Raleigh
†Bradley Clayton Roberts	Henderson
†*Louis Carlton Roberts	Raleigh
†Sonja Reneé Robinson	Winston-Salem
†*Suha Ahmad Sabi	Raleigh
†Susan Dianne Sanders	Raleigh
†Lorena Maria Segura	Tegucigalpa, Honduras
†Harvey Todd Sharpe	Burlington
†Karlene Marie Sheerin	Fayetteville
†Kenneth Jay Smith	Greensboro
†Andra Faith Sparks	Burnsville
†Melanie Rhea Sparrow	Cary
†Lisa Kay Stanley	Tallahassee, FL
†Lori Ann Stuart	Teachey
†Sandra Lynne Sumner	Winston-Salem
†Gary Stokes Swann	Greensboro
Michael Steven Tekely	Burlington
†***Jonathon Todd Trivett	Raleigh
Chris Darryl Villanova	Burlington
†Hugh Carroll Vincent, III	Murfreesboro
†Steven Hughes Viola	West Jefferson
†Marty Kipp Whitley	Raleigh
†Brenda Kay Whitlow	Cohasset, MA
†Gary Richard Williams	Greensboro
†Sheryl Lynne York	Essex Junction, VT
†Angela Robin Zimmerman	High Point

BACHELOR OF SCIENCE IN ECONOMICS

Degrees Conferred June 27, 1985

Ajay Kumar Anand	Sikeston, MO
†Lee Roy King	Waynesville

Degrees Conferred August 8, 1985

Christopher Charles Grady	Pineville
Benjamin Brian Matthews	Burlington
Thomas Harrison Midgett	Raleigh
Paul Stuart Waldruff	Madison
Wendy Lee Wiles	Matthews

Degrees Conferred December 17, 1985

†*James Edward Ashe	Winston-Salem
Melinda Lee Corn	Raleigh
David Lawrence Heller	Raleigh
***Kevin Gerard Lawrence	Raleigh
Mark Paul Schlake	Raleigh
Wayne Dennett Smith	Raleigh
Clifton Cornell Thornton	Conover
Steven Bradley Williamson	Lucama

Degrees Conferred May 10, 1986

*Mark Lynn Besanson	Raleigh
Richard Thomas Dunbar	Durham
†Victoria Ann Kutchuk	Greensboro
†Euripidea Alicia Marrow	Oak City
Lori Jean Masters	Hillsborough
*David Seth Metsch	Oradell, NJ
Ghassan Riad Oueijan	Raleigh
Russell Brenton Smith	Raleigh
†*Jeffrey Scott Spiro	Raleigh
Ronald George Steiger, Jr.	Altavista, VA

BACHELOR OF ARTS IN ENGLISH

Degrees Conferred August 8, 1985

Mary Glenn Barwick	Raleigh
Lucille Anne Cohen	Pittsburgh, PA
***Thomas Edison Dupree, Jr.	Raleigh

Degrees Conferred December 17, 1985

†Amy Lee Elkins	Durham
*Barney Mansfield Graham	Cary
James Kevin Hart	Kinston
Martha Carolyn Horowitz	Raleigh
*Katheryn Kabrick Lempert	Raleigh
Thomas William Mansfield	Cary
Nancy Myers Palmour	Greensboro
Andrea Lee Phillips	Raleigh
Lee Creef Satterfield	Houston, TX
Susan Gail Simendinger	Charlotte
Cara Dawn Thomas	Cove City
Laura Melanie Thomas	Redding Ridge, CT
Caroline Anne Waller	Kinston
Margaret King Wolfe	Raleigh

Degrees Conferred May 10, 1986

Richard Armour Bryant	Raleigh
***Dorothy Ray Cashell	Galveston, TX
Richard Stephen Crescini	Virginia Beach, VA
Carol Stromak DeWitt	Cary
*Lorraine Monica Edwards	Raleigh
Laurie Leigh Everson	Edenton
*Barney Mansfield Graham	Cary
*Clifford Maxwell Green	Raleigh
Lillie Lucille Harward	Cary
*Beth Ann Heiney	Greensboro
Shelley Ann Hendrickson	King of Prussia, PA
James Bryson Hyatt	Whittier
Katherine Nell Kyle	Overland Park, KS
Lynne Marie Marsden	Rockville, MD
Paul Matt Matthews, Jr.	Winston-Salem
***Wendy Renee McDaniels	Mollie

†Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

Martha Elaine Oehman	Winston-Salem
Phillip Marvin Pitchford	Fayetteville
**Ida Patricia Pleasants	Cary
†**Kathryn Patricia Roe	Cary
Michael Deal Simpson	Raleigh
Kimberly Bellamy Woodall	Cary
***Jaine Schmidt Wyatt	Durham

BACHELOR OF ARTS IN FRENCH LANGUAGE AND LITERATURE

Degrees Conferred December 17, 1985

***Jennifer Paige Choate	Lincolnton
Janet Lily Dinh	Raleigh

Degrees Conferred May 10, 1986

*Simine Albouyeh	Raleigh
Anna Theresa Crettier	Raleigh
†**Lizabeth Claire Horstman	Durham
†Jo Ann Johnson	Whitakers
†Judy More Payne	Raleigh
Cathy Maria Quiroz	Charlotte

BACHELOR OF ARTS IN HISTORY

Degrees Conferred August 8, 1985

William Marion Brooks, Jr.	Raleigh
Nancy Margaret Butt	Charleston, SC
Sharon Christiana Kelley	Raleigh

Degrees Conferred December 17, 1985

Bradley Scott Albee	Dunwoody, GA
John Price Boney	Wilmington
Andrew Chris Christakos	Durham
David Carroll Cox, Jr.	Raleigh
*Terrence Patrick Gannon	Joliet, IL
*Charlotte Eleanor James	Wilmington
Amory Mellen, III	Winston-Salem

Degrees Conferred May 10, 1986

Laura Lee Buckley	Hackensack, NJ
**Linda Paige Burns	Raleigh
Shari Lynn DePasquale	Cary
Hobson Ivan Gattis, III	Raleigh
†**Lizabeth Claire Horstman	Durham
Walter Lamar Jones	Hobbsville
Roberta Anne Leighton	Brevard
**Jami Michele Poole	Lincolnton
Mark Kent Price	Wallace
Lee Rozakis	Raleigh
*Michael Waldo Strickland	Raleigh
Allen Richard Temple	Raleigh
Tonya Michelle Wall	Durham

BACHELOR OF SCIENCE IN HISTORY

Degree Conferred May 10, 1986

Michael Dean Bryant Raleigh

BACHELOR OF ARTS IN MULTI-DISCIPLINARY STUDIES

Degrees Conferred June 27, 1985

*LaRaine Papa-Jewell Pittsburgh, PA
Martha Shotwell Stark Stovall

Degrees Conferred December 17, 1985

***Susan Forbes Babcock Raleigh
Timothy Joseph Esposito San Pedro, CA
Aura Emma Maas Raleigh

Degrees Conferred May 10, 1986

***Julie Anne Sandel Bulkley Durham
†Christopher Bernard Cook Charlotte
Robert Wayne Gales Stanley
Lisa Mardina Stallings Chiquapin
Timothy Alan Tulis Raleigh

BACHELOR OF ARTS IN PHILOSOPHY

Degrees Conferred June 27, 1985

Deborah Grace Byrd Fayetteville
James Cicero Durham, IV Burlington

Degrees Conferred December 17, 1985

†Robert Christopher Taylor Raleigh
Jacqueline Denise Williams Windsor

Degrees Conferred May 10, 1986

†*Suzanne Lea DeMarrais Cary
Hoy Jeffery Johnson Asheville
***Patricia Ann Spiller Oklahoma City, OK
***David Creech Webb Raleigh
David Warren Wilson Raleigh
Richard Michael Wilson Wilmington

BACHELOR OF ARTS IN POLITICAL SCIENCE

Degrees Conferred June 27, 1985

Marshall Dennis Downey Oxford
Sara Kathleen Hudnall Winston-Salem
Sylvia Lynette Kimel Winston-Salem
Lindsay Wayne McLaughlin Mooresville
Jeffrey David Wehmuelier Midland, MI

Degrees Conferred August 8, 1985

Barbara Yvonne Barnes Dale City, VA

Ernest Guy Blough, Jr.	Spring Lake
Jeffery Wayne Boswell	Wilson
Joseph Mark Ferretti	High Point
Jeffrey Jay Haggerty	Cary
Patricia Lynn Hall	Garner
Stephen David Hall	Clemmons
Frances Kay Lyerly	Raleigh
Stephen Eugene Medling	Asheville
Steven Daniel Tobey	Raleigh
Kim Denise Walker	Winston-Salem

Degrees Conferred December 17, 1985

***Alma Hayes Biagini	Cherryville
Minnie Katherine Boone	Lumberton
Linda Karen Boyd	South Plainfield, NJ
**Linda Bass Cauffman	Raleigh
Nathan Montgomery Cousar	Charlotte
Sherald Lee Cratch	Washington
Tim McCoy Duke, Jr.	Louisburg
Robert Wesley Gregory	Benson
Robert Wade Harvey	Raleigh
Michael Wayne Hatchell	Roanoke Rapids
Lawrence Jarvis	Jacksonville
Jonathan Paul Kane	Cullowhee
Richard Lamar Kennedy	Charlotte
John Charles Kernodle	Burlington
William Bennett Little, III	Raleigh
Mary Lisa Martin	Ahoskie
Jennifer Reneé Melvin	Oxford
Sandra Michelle Powell	Fuquay-Varina
Alton Battle Smith, Jr.	Raleigh
†Robert Christopher Taylor	Raleigh

Degrees Conferred May 10, 1986

Jimmie Gray Armstrong, Jr.	Rocky Mount
Pamela Ann Baldwin	Pittsboro
Lisa Carol Bowman	Rocky Mount
Sheila Anne Boykin	Spring Lake
Martha Randall Browning-Mandell	Raleigh
Virginia Hendren Bryan	Jefferson, Ga
Amy Suzanne Butterworth	Asheville
Evonne Denise Carawan	Morehead City
†Barbara Susanne Catlin	McLean, VA
Thomas Fox Colhoun	Winston-Salem
Lindsay Allan Cooper	Medford, NJ
**Tracy Lynn Cordell	Garner
Anthony James Cotton	Dudley
Jeffrey Max Cutler	Farmville
Mary-Katherine Davidson	Alexandria, VA
Tammy Luane Davis	Randleman
Stephen Marsh Dean	Raleigh
Philip Ray Devoe	Arlington, TX
Larry Lee Eubanks, Jr.	Winston-Salem

†Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

Richard Kincaid Eudy	Raleigh
*Arthur Jay Everette	Wilmington
Ralph Louis Franklin	Raleigh
Bruce Henry Grisct, Jr.	Winston-Salem
Jason Vincent Harvard	Rocky Mount
Teresa Hicks	Kittrell
Robert Kevin Hight	Fayetteville
Dorothy Carol Holcombe	Asheville
*Robert Paul Huber	Winston-Salem
Reginald Wendell Hunter	Fayetteville
John Wallace Kirby	Raleigh
David Bruce Kumhyr	Raleigh
Tiffany LaVerne Lathan	Spindale
Pamela Denise Laughinghouse	Greenville
Ernie Andrew Likens	Jacksonville
Gordon Keith Loflin	Denton
Deitra Diane McLean	Hope Mills
*Tamara Garner Miller	Raleigh
*Frances Hyman Mizesko	Morehead City
David Michael Monk	Winston-Salem
*Linda Anne Morgan	Monroe
Anita Gay Phillips	Raleigh
Donna Lorraine Primrose	Washington, DC
Charles Thomas Saunders	Charlotte
Julian Douglas Scott	Raleigh
Robert Lincoln Sherk	Winston-Salem
Marc Jonathan Smith	Gloucester
Pamela Elaine Stanley	Greensboro
William Herman Tigner	Fayetteville
*Tomi Jane White	Raleigh
Debbie Whitmore	Burlington
Christopher Cordine Young	Fayetteville

BACHELOR OF SCIENCE IN POLITICAL SCIENCE

Degrees Conferred December 17, 1985

Scott Kelly Jones	Benson
Kenneth Wayne Stallings, II	Rocky Mount

Degrees Conferred May 10, 1986

William David Bower	Raleigh
*John Edward Bruder	Essex Fells, NJ
Brian Russell Hanson	Raleigh

BACHELOR OF ARTS IN SOCIOLOGY

Degrees Conferred June 27, 1985

Randee Robin Agee	Durham
Cheryl Lorraine Ballew	Fayetteville
Lonette Evans	Fuquay-Varina
Garnett Ruth Henson	Winston-Salem
Barbara Gunter Kirkland	Raleigh
Kathleen Mary Klingler	New Canaan, CT
*Arlene Mary Lulavage	Detroit, MI
Mary Frances McKenzie	Winston-Salem
Leonard Ray Watts	Charlotte
Deborah Anne West	Raleigh

†Co-major *Cum Laude **Magna Cum Laude ***Summa Cum Laude H Honors Program

Degrees Conferred August 8, 1985

Andrew Ray Bayard	Phoenix, AZ
Clifton Dawin Brummitt	Oxford
Robert William Goettelmann	Manhasset, NY
Sara Caroline Harrell	Harrells
Edvard Hansen Litaker	Matthews
Terese Marie Schmoll	Fort Wayne, IN
Pamela Michelle Smith	Weldon

Degrees Conferred December 17, 1985

David Graham Carter	Whiteville
Larry Keith Carter	Oxford
Eric John Hallberg	Kingston, NY
*Ayman Ahmad Sabi	Raleigh
Ervene Boyd Sonner	Raleigh

Degrees Conferred May 10, 1986

Ralph Michael Caldwell	Raleigh
Rebecca Renee Carlton	Rose Hill
Johnny Wright Elmore	Dunn
Richard Roland Grigley	Angier
Jonathan Baumann Hanscel	Pittsford, NY
Annazette Jenkins	Wilmington
Ronald David Kosor	Ruffsedale, PA
Tandra Elizabeth Lewis	Henderson
Joseph Richard Maciejewski	South Bend, IN
Raymond Thomas Phillips, Jr.	Huntersville
Mary Elizabeth Pollander	Winston-Salem
Anne Kathleen Poole	Raleigh
James Alexander Ritcher	Raleigh
Teresa Lynn Rouse	Fairfax, VA
Lynn McMath Skinner	Wake Forest
*Sarah O'Neal Sugg	Raleigh
Karen Marie Welch	Raleigh
Ann Lee Weller	Winston-Salem
Stacy Lynne Williams	Morganton
***Kimberlea Hendricks Williford ..	Greenwood, SC

BACHELOR OF ARTS IN SPANISH LANGUAGE AND LITERATURE

Degree Conferred June 27, 1985

Alan Merle Johnson	Morrisville
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Degree Conferred August 8, 1985

†Isabel Maria Santo Tomás	Raleigh
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Degree Conferred December 17, 1985

†Emily Frances Harrell	Raleigh
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Degrees Conferred May 10, 1986

**Nydia Bonilla Dohnert	Rio Piedras, PR
†**Daniel Owen Farris	Weaverville, CA
†Kay Marianne Glans	Miami, FL
†Maria Del Pilar Law	Winston-Salem
*Debra Gay Miller	Raleigh

†Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

Amy Grace Weller	Winston-Salem
†Jamey Lynn Widener	Gastonia
Jeffery Allen Yeargin	Raleigh

BACHELOR OF ARTS IN SPEECH COMMUNICATION

Degrees Conferred June 27, 1985

Richard Howard Bryant, Jr.	Smithfield
Daniel Thomas Cuffe	Raleigh
Aimee Susan Estes	Charlotte
Jacquelyne Lee Gordon	Lumberton
*Brenda Jordan Hunsinger	Spring Hope
Matthew McQuinn Miller	Cary
Paul Bingaman Miller	Malvern, PA
Julie Loraine Napier	Marshville
Sharon Parker Porter	Garner
Mary Elizabeth Staley	Burlington
**Christopher Jerome Teets	Raleigh
Robert MacCutcheon Truslow	Charlotte
Jeffrey Scott Vaughn	Mooreville
Sonya Gay Walters	Louisburg

Degrees Conferred August 8, 1985

Brenda Ellen Babyak	Raleigh
Martha Austell Byers	Charlotte
Norman Vincent Clark	Pittsboro
Kathryn McKee Cole	Elizabethtown
Darryl Lemont Harris	Charlotte
Floyd Wayland Harris	Raleigh
James Clyde Hickey, IV	Rockledge, FL
Harold Gene Meeks	Raleigh
Michelle Katherine Moore	Fayetteville
John Haughton Putnam	Cherryville
Wanda Lynn Weaver	Asheboro
Crystal Faith Wilder	Cary
Phillip Roderrick Williams	Wilson

Degrees Conferred December 17, 1985

John Fleming Atkinson	Durham
*Chrystal Angelia Bartlett	Raleigh
Douglas Alfred Blohm	Melville, NY
Carrie Lynn Bromberg	Washington, DC
Laura Elizabeth Brunner	Charlotte
Ray William Cline	Concord
Candy Folb Evans	Buxton
Deborah Murray Fleming	Raleigh
William James Fuchs	Raleigh
Jeffrey Hoyle Gravley	Oxford
Jamie Susan Grice	Smithfield
Troy Dean Haynes	Raleigh
David Eugene Haywood	Raleigh
Michael Arthur Keener	Sylva
Anne Reynolds Lindsay	Morehead City
Sally Kim Marks	Fayetteville
Todd Alan McGee	Clemmons

Catherine Michelle Montgomery	Cary
Laura Lee Montgomery	Matthews
Deborah Suzanne Parker	Raleigh
Jeffrey Royace Pipkin	Raleigh
Anthony Warren Porter	Boston, MA
Jennifer Creasy Richardson	Raleigh
Janet Lee Russell	Kendall Park, NJ
†Suzanne Gail Saunders	Troy
Lee Austin Stevens, Jr.	Smithfield
Harold Lewis Thompson	Raeford
Christopher Odell Tillman	Siler City
Nancy Graham Wilson	Jacksonville
Joe Hereford Wolfe	Henderson

Degrees Conferred May 10, 1986

Frederick Lawton Allen	Lenior
Cynthia Lynn Bagley	Dunn
Judeann Frances Bailey	Raleigh
Suzanne Caroline Beller	Raleigh
Eric Girard Bullock	Rocky Mount
Carla Bristow Burgess	Harrells
Patrick Alan Buskill	Winston-Salem
†Barbara Susanne Catlin	McLean, VA
Henry Hautman Chambless, III	Rocky Mount
Mona Lisa Coley	Goldsboro
Kristy Michelle Conrad	Winston-Salem
†Christopher Bernard Cook	Charlotte
Dawn Breynae Cooper	Roseboro
*Gwendolyn Moore Cox	Raleigh
†Suzanne Lea DeMarrais	Cary
Vivian Genevieve Denkins	Winnabow
Alan David Dickson	Raleigh
Rodney Eugene Dixon	Willow Springs
Sonya Jean Dunn	Nashville
Mary Ann Dunnmon	Fayetteville
Mary Elaine English	Bladenboro
Richmond Bullen Gage, III	Dunn
Allison Boyd Gore	Southport
James Malcolm Graham	Cary
Mary Junetta Graham	Greensboro
Earle Ross Haire, Jr.	Hendersonville
Kimberlea Patrick Hannah	Raleigh
Julie Ann Hathcock	Raleigh
Jonathan Hart Hoffman	New Canaan, CT
Donald Jerome Holder	Athens, GA
Fredrick Carlton Howell	Lumberton
LaDonna Lori Hull	Mount Airy
Lisa Danielle Humphrey	Raleigh
Malcolm Ward Isley	Durham
Sophia Karteris	Fayetteville
Corinne Marie Kelly	Chicago, IL
Tammy Linn Laughter	Hendersonville
LeAnna MarSu Lewis	Fayetteville
David Lee Mann	Fayetteville
*Tammy Cecilia Martin	Fayetteville

†Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

Lori June Mayes	Hickory
Kathleen Anderson Milinichik	Trinity
Connie Louise Mullins	Marion
David Dale Murphy	Asheville
Joseph Edward Oliver, Jr.	Greensboro
Paul Jerome Otto	Raleigh
John Randolph Parker	Raleigh
Lynn Clark Parker	Raleigh
Willetta Sanya Parson	Winston-Salem
Roger Alvin Patterson, Jr.	Raleigh
†Judy More Payne	Raleigh
Celestine Perkins	Williamston
Jeffrey Harvey Pierson	Pennington, NJ
Carol Puckett	Raleigh
Bonnie Lavern Reynolds	Greensboro
**Staci Anastasia Rhodes	Charlotte
Cassandra Evette Rodgers	Williamston
†**Kathryn Patricia Roe	Cary
Jayne Sue Settlemyre	Newton
Peggy Anita Sexton	Marshall
Andrea Sloan Shelton	Liberty
Rebecca Anne Sisson	Raleigh
*Suzanne Elizabeth Staton	Hillsborough
Kathryn Ruth Torain	Durham
**Karen Annette Tucker	Pilot Mountain
Jeffrey Michael Ward	Raleigh
Morris Wheeler West, Jr.	Oxford
Helen Renee White	Siler City
†Jamey Lynn Widener	Gastonia
Samuel Sykes Williams, Jr.	Charlotte
Lisa Ann Wilson	Durham
*Karen Leigh Yocher	Raleigh

BACHELOR OF SOCIAL WORK

Degree Conferred June 27, 1985

***Bridget Anne Simmerman	Raleigh
---------------------------------	---------

Degrees Conferred August 8, 1985

Patricia Roberson Batten	Raleigh
*Heather Jo-Nelle Handley	Charlotte

Degrees Conferred December 17, 1985

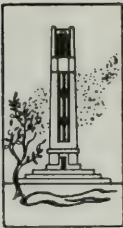
*Marlene Louise Dery Colbeck	Raleigh
Shirley Evette Lacy	Jacksonville
David Warren Leary	Wake Forest
*Jeni Rood	Wappingers Falls, NY

Degrees Conferred May 10, 1986

Anne Rivers Achurch	Raleigh
Kimberly Ann Alexander	McLeansville
Kimberly Lewis Kusel	Barrington, IL
Dianne Dickerson Perkinson	Henderson
*Andrew McMillan Purcell	Raleigh
Rhonda Marie Scott	Burlington
Laura Hadley Thompson	Fayetteville
***Lisa Denise Tucker	Grafton

†Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

School of Physical and Mathematical Sciences



BACHELOR OF ARTS IN CHEMISTRY

Degree Conferred June 27, 1985

******Ralph Alvis Souder, Jr. Arapahoe

Degrees Conferred August 8, 1985

†Pierette Banker Raleigh
Ross Vincent Martin, Jr. Statesville
†Michael Worley Oddo Charlotte

Degrees Conferred December 17, 1985

Cynthia Walker Church Greensboro
†Benjamin Franklin Dowell Winston-Salem
†Amy Lee Elkins Asheville
Kimberley Ann Jessup Rocky Mount
Albert Richard Miner, II Cary
Richard Michael Nass Rye, NY
Scott Whiting Neil Horseheads, NY
Todd Lee Smoot Atlanta, GA
*Tiffany Reeves Weeks Jamestown

Degrees Conferred May 10, 1986

†***Ghassan Salim Al-Awar Karnayel, Lebanon
Wiley Forbus Betts Raleigh
H*George Craig Clinard High Point
**Anna Hassinger Coffin Durham
H***Jeffrey Richard Daw Chapel Hill
H†**Sarah Louise Dolby Charlotte
Lisa Gayle Fulford Siler City
†***David Widiiah Koury Sanford
***Gray William Rushin Gaithersburg, MD
†*Jennifer Ann Scott Augusta, GA
Thomas Joseph Smith Rocky Mount
Ronald Rae Willett Sanford

BACHELOR OF SCIENCE IN CHEMISTRY

Degrees Conferred December 17, 1985

Donna Annette Franklin Dallas
Robert David Johnson Statesville

Degrees Conferred May 10, 1986

Barbara Lee Adams Cary
Angela Jeanette Allen Greensboro

Eric Eugene Boros	Raleigh
†Charles David Burton, Jr.	Charlotte
Mojgun Company	Raleigh
Peter Thomas Goeller	Raleigh
H***Christie Ann Hopkins	Walnut Cove
Carolyn Jeanne LeFevre	Philadelphia
Merritt Leanne Lloyd	Raleigh
†*Jo Karen Lowman	Raleigh
Dawn Kimberly Mathews	Mooreville
Karen Sue O'Brien	Greensboro
†Melvin Andrew Park	Raleigh
Robert William Ray	Hillsborough
Thomas Coward Roddey, Jr.	Charlotte
*Nada Farah Samaha	Raleigh
Michael Steven Slayman	Smithsburg, MD
Charles Edward Stoner, Jr.	Westminster, MD
H*David Smith Talton	New Bern

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

Degrees Conferred June 27, 1985

***Ingrid Ammondson	Raleigh
Thomas Patrick Bigelow	Brevard
*Martin Nathaniel Brock	Madison, AL
*Kelvin Sebron Bryant	Fayetteville
*Michael Anthony Coleman	Raleigh
*David Carroll Cromwell	Pittsboro
***Vicki Ellen Jones	Thomasville
Wanda Elaine Jones	Fayetteville
Joseph Allen Morgan	Charlotte

Degrees Conferred August 8, 1985

Karen Terry Haneline	Winston-Salem
Elizabeth Pearce House	Cary
Lou Ann Huey	Marshall
Martha Bryan Lowe	Burlington
Herbert Lee Pfendt	Pilot Mountain
Bobby Gia Pham	Minot AFB, ND
Myra Louise Rice	Elizabeth City

Degrees Conferred December 17, 1985

Stephen Sebastian Adams	Cary
*Anne Loraine Adcock	Fuquay-Varina
Mohd Radwan Al-Tarabichi	Damascus, Syria
James Paul Barringer, III	Salisbury
Laura Leigh Bellingrath	Raleigh
Pamela Theodore Besseas	Charlotte
Martin Edward Bolick	Charlotte
Matthew Lewis Brinton	Charlotte
Julian Scott Carr	West End
Diana Lynn Clemson	Timonium, MD
**Diane Marie Denny	Greensboro
Paul Edwin Dumas, Jr.	McLeansville
Karen Marie Ebinger	Elon College
Karen Kay Schneider Edmundson	Raleigh
Sheila Fitzgerald Evans	Elsmere, NY

†Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

Terry Lou Falke	Raleigh
Catherine Cicchino Fowlie	Kearny, NJ
Lisa Kay Frye	Raleigh
**Cornelia Anne Gardner	Saratoga
Steven Edward Giles	Charlotte
Morris Carroll Gold, Jr.	Shelby
Stephan Karl Gruetzmacher	Fayetteville
*Roy Thomas Harwell, Jr.	Statesville
Eva Dawn Hensley	Troutman
Finette Renae Hill	Westfield
Virginia Lynne Hill	Albemarle
Ronald Michael Holanek	Fayetteville
Edward Dean Holloman	Wilson
Teresa Blount Hopkins	Wadesboro
H***Rebecca Ann Huffman	McLean, VA
Gail Renee Jeans	Cary
Joseph Vincent Jeppi, Jr.	Baltimore, MD
***Melissa Alease Jones	Zebulon
Deborah Jean Kapp	Fayetteville
Gordon Lyle Keener	New Bern
*Dianne Leonard King	Albemarle
Aphrodite Sam Koskinas	Charlotte
David Robert Lathan	Monroe
Lisa Anene Lawhon	Concord
Raymond Deforest Leadbetter	Rocky Mount
*Deborah Joy Lee	Clayton
*Jeffrey Alan Lucovsky	Cary
Carolyn Jane Lynch	Winston-Salem
Clyde Swindell Mann	Newport
H***Janet Lynn Marks	Charlotte
Ralph John Marrujo	Winston-Salem
Cynthia Kametches McCrickard	Cary
Larry Roger Melton	Fayetteville
†Gwyn Ellen Middleton	Charlotte
Phillip Roger Moore	Raleigh
Allene Taylor Morton	Oxford
Willie Robert Patten, Jr.	Raleigh
*Mary Jones Patterson	Charlotte
Sandra Zovath Perruzzi	Raleigh
Maily Thi Promislow	Fayetteville
Thomas Scott Quinn	Sanford
Timothy John Sampair	Raleigh
Mickey Dean Scott	Mount Airy
Robert Allan Shiels	Raleigh
**Ann Bieghler Shirk	Raleigh
*Donald Lee Sparks	Taylorsville
**Ann-Marie Margaret Sullivan	Charlotte
Robert Edward Swofford	Kings Mountain
*Sara Iris Till	Rockingham
Chau Le Tran	Winston-Salem
Keith David Turner	Raleigh
*Joseph Victor Vohwinkel	Chapel Hill
William David Walters	Raleigh
Nancy White	Winston-Salem
Gene Anderson Wicker, Jr.	Burlington
*Claire Kelly Wilder	Franklinton
Carla Blanche Wiser	Raleigh

†Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

Degrees Conferred May 10, 1986

*Leo Craig Adams	Andrews
Curtis Jay Alexander	Raleigh
James Edward Armfield	Greensboro
*Suha Salah Beidas	Raleigh
Larry Kevin Bellamy	Forest City
Phyllis Anne Bishop	Raleigh
John Anthony Bittle, III	Fayetteville
Robert Allen Blom	Traphill
James William Bolick, III	Wilmington
Lawrence William Bookstaver	Raleigh
*Kevin Ray Brasche	Pineville
†*Theresa Ann Bright	Raleigh
**Robert Wayne Brodd	Raleigh
Lisa Breeden Brown	Charlotte
Nancy Annette Buff	Connelly Springs
***Neal Robert Caliendo, Jr.	Raleigh
**David Alan Cando	Virginia Beach, VA
Karen Denise Carey	Hendersonville
***David Brown Caudle	Albemarle
Gregory Eugene Chamblee	Selma
Peter Matthew Chenard	Erie, PA
*Laura Anne Clarke	Raleigh
Wendy Lynn Clinard	Raeford
Christopher David Cline	Morganton
*Lisa Nanette Connor	Morganton
*Matthew Brent Cook	Danville, VA
Steven Wayne Cox	Mount Airy
†Phillip Anthony Dean, Jr.	Raleigh
Michael Dwight Denning	Benson
†Troy Alvin Doby, Jr.	Raleigh
Natalie Ann Dreighton	Goldsboro
***Miles Daly Duke	Boone
†David William Easter	Cary
Kimberly Sue Farmer	Wilson
†**Dennis Eugene Freeland	Raleigh
Ricky Ogilvie Freeman	Hendersonville
Hoyle James Fulbright, Jr.	Lexington
James Campbell Fulbright	Bristol, VA
Kathy Regina Gaines	Pensacola, FL
Nathaniel Williams Garrison, Jr.	Burlington
Michael Steven Gilbert	Salisbury
Phillip Scott Godwin	Micro
Angela Michele Graham	Durham
**Kimberly Jo Grice	Raleigh
Wendy Sue Griffin	Wilson
William Glenn Gross	Sanford
Nancy Lee Hardy	Sanford
Richard William Harkness	Dudley Shoals
***Barry Taylor Henderson	Ellerbe
Anthony Clark Hicks	Eden
Steven Henry Hicks	Rocky Mount
Herman Ross Honeycutt, Jr.	Raleigh
Harold Russell Howell	Lumberton
**Barry Wayne Huggins	Hickory

†Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

Joseph Barry Hutchens	Sandy Ridge
*Robert Glyn Irvin	Wilson
David Kerr Jeffreys	Burlington
†Jo Ann Johnson	Whitakers
†***Christopher Howard Jolly	Charlotte
Joel Frederick Kilpatrick	Cullowhee
David Crayton Kinsey	Benson
Gavin Ludwig Koch	Raleigh
Kenneth Nels Larsen	Raleigh
Richard Paul Lehner	Syosset, NY
Stanley Arrington Lewis, Jr.	Roanoke Rapids
Anne Grace Lineberger	Dallas
**Richard James Lombardi, Jr.	Dunwoody, GA
***Carleton Moon Luck, Jr.	Charlottesville, VA
**David Jackson Marks	Acushnet, MA
Quinton Thompson Martin, III	Raleigh
***Alan Jason McCabe	Fayetteville
*Michael Joseph McGee	Raleigh
**Susan Carol Mears	Burlington
Wendy Lou Medlin	Morrisville
Tim Jay Midkiff	Wilmington
Richard Andrew Mobley	Washington
Bryan Donald Mohorn	Henderson
James Michael Mosley	Mount Airy
Joel Kelly Nance	Mebane
†Marian Hazel Nelson	Kernersville
Van Hong Nguyen	Greensboro
William Eugene O'Connor	Charlotte
Judson Rudolph Phillips	Cary
John Bailey Pridgen, III	Raleigh
Joey Lee Prince	Holly Springs
Renee Colette Rabeler	Delhi, NY
Rodney Edward Radford	Goldsboro
*Michelle Weisheit Ratliff	Hendersonville
Charles Augustus Reap, III	Chapel Hill
Karen Ann Peterson Rogers	Jackson, MI
Myra Ellen Smith	Lincolnton
***Travis Hamilton Smith	Kernersville
Susan Claire Spencer	Raleigh
†Jeffrey Scott Spiro	Raleigh
*George Logan Steel	Raleigh
Charles William Summey	Hickory
Bruce Horner Terrell	Mebane
*Sandra Marie Thomas	Sanford
†Mark McCoy Thompson-Bullock	Durham
Thomas Kent Traywick	Marshville
***Teresa Lynn Trogdon	Asheboro
Jeffrey Eugene Wall	Winston-Salem
Carolyn Elizabeth Watson	Mount Airy
Danny Ira Wellisch	Asheville
*William Randy Wheeler	Benson
†***Gregory Stuart Whitcomb	Raleigh
Gehrig Henderson White	Evanston, IL
Robert Ott Wilson, Jr.	Richboro, PA

†Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

BACHELOR OF ARTS IN GEOLOGY

Degrees Conferred August 8, 1985

William Scott Caldwell	Charlotte
Phillip Howard Cox	Lexington

Degree Conferred December 17, 1985

Kenneth Blanchard White	Raleigh
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Degree Conferred May 10, 1986

Timothy Glynn Smith	Raleigh
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BACHELOR OF SCIENCE IN GEOLOGY

Degree Conferred June 27, 1985

Mark Daniel Baldwin	Siler City
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Degrees Conferred August 8, 1985

Clancy Lee Covington	Ellerbe
Joel Lee Hersh	Silver Spring, MD
*Martin Leon Loy, Jr.	Burlington
Michael Allen McDannell	Gettysburg, PA

Degrees Conferred December 17, 1985

Cynthia Leigh Baity	Winston-Salem
Kimbel Tracy Caulk	Hamlet
Robert Patrick Cooke	Chapel Hill
Robert William Johnston	Charlotte
Steven Edgar Shouse	Durham

Degrees Conferred May 10, 1986

Haynes Dodd Campbell	Taylorsville
David Luther Rice	Shelby
Jerry Wayne Roberts	Winston-Salem
H**Phillip Daniel Royall	Banner Elk
*Dona Elizabeth Shaw	Chapel Hill

BACHELOR OF SCIENCE IN MATHEMATICS

Degrees Conferred June 27, 1985

Karen Denise Hill	Wilson
Jacqueline Wanda Jeffries	Burlington
David Wilson Long	Holmes, PA
Pavel Sergei Olchovik	Raleigh

Degree Conferred August 8, 1985

Antonia Edward Lindsey	Fayetteville
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Degrees Conferred December 17, 1985

†*Melissa Anne Beretich	Clinton
Durward Lee Berrier	Winston-Salem
Peter Bradford Brown	Statesville
Odester Ann Elliott	Fayetteville
David Alan Kiser	Greensboro

Leslee Ann Kornfeld	Charlotte
Sara Jane Laase	Springfield, VA
*Dennis Paul Nettesheim	Raleigh
Gregory Lincoln Pierce	West Jefferson
†Claudia Grace Smith	Rocky Mount
Michael Stephen Whitcher	Troy

Degrees Conferred May 10, 1986

Tara Marie Aiken	Creedmoor
†Jacqueline Marie Amidon	Havelock
Donna Joy Andersen	Raleigh
Wanda Keturah Anderson	Columbia, SC
†*Theresa Ann Bright	Raleigh
†Laric Eugene Copes	Beaufort
*Brenda Lee Coughlin	Trumbull, CT
Daniel Lee Fox	McLeansville
Paul Steven Harris	Raleigh
Sharon Teresa Harris	Raleigh
Shaun Graves Huggins	Reidsville
†John Talbert Jackson	Winston-Salem
Jamie Alan Johnson	Rockingham
†Bryan Joseph Kincaid	Lenoir
**Lisa Jean Kroll	Clayton
†Victoria Ann Kutchuk	Greensboro
†Marian Hazel Nelson	Kernersville
Stacy Maurice Offer	Fayetteville
H†***Keith Steven Promislow	Charlotte
Jeffrey Ned Ross	Burlington
†*Jeffrey Scott Spiro	Raleigh
Teresa Gail Taylor	Lucama
†**Jill Karen Thompson	Zebulon

BACHELOR OF SCIENCE IN METEOROLOGY

Degree Conferred June 27, 1985

Judith Carol Sharp	Goldsboro
--------------------------	-----------

Degree Conferred August 8, 1985

Garner Flowers Andrews, Jr.	Raleigh
----------------------------------	---------

Degrees Conferred December 17, 1985

John Michael Cooney	Virginia Beach, VA
David Bruce Elson	Holland, PA
Edward Cabiness Melton, III	Kitty Hawk
James Robert Robenolt	Raleigh

Degrees Conferred May 10, 1986

Harold Stanley Austin, Jr.	Southern Pines
Joseph Glenn Dew	Bailey
Mark Lewis Faucette	Burlington
Jerry Michael Griffin	Fayetteville
Kenneth Bruce Johnston	Hudson
***Michael Dismas Krajnak	Athens, OH
*Norman Ray Modlin	Williamston
***Kim Margaret Talbert	California, MD
**Ray Paul Young	Cary

†Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

BACHELOR OF SCIENCE IN PHYSICS

Degree Conferred June 27, 1985

†**Karl Claudius Garrison Raleigh

Degrees Conferred December 17, 1985

David Loren Carroll Winston-Salem
Bolling Reynolds Wilson, Jr. Montreat

Degrees Conferred May 10, 1986

Raymond Patrick Burns Raleigh
*Stephanie Cate Dial Raleigh
David Rawlins Duling Eden
*Michael David Gildner Raleigh
†Bryan Joseph Kincaid Lenoir
†Mark Anderson Newton Charlotte
†Melvin Andrew Park Raleigh
H†***Keith Steven Promislow Charlotte
H***Donald Albert Shiffler, Jr. Kinston
Douglas Charles Weber Denver

BACHELOR OF SCIENCE IN STATISTICS

Degree Conferred June 27, 1985

Alastair Storm Browne Newport, RI

Degrees Conferred August 8, 1985

Rene Ann Schlotzhauer Winston-Salem
Chih Shin Wu Taipei, Taiwan

Degrees Conferred May 10, 1986

Edward Robert Gelson Toms River, NJ
Maureen Ann Hanifer Greenville
Jean Wilson Holliday Asheville
Christopher Lynn Johnson Clayton
H***Christina Anne Keene Owego, NY
*Barbara Alison Prillaman Greensboro
Keith William Schellenberger Chalfont, PA
Lucille Danita Sidberry Wilmington

School of Textiles



BACHELOR OF SCIENCE IN TEXTILE CHEMISTRY

Degree Conferred August 8, 1985

Wendy Carlene Camp Greensboro

Degrees Conferred December 17, 1985

*Amy Lynn Anderson Charlotte
 Ahmet Teufik Atahan Istanbul, Turkey
 **Nancy Gayle Chimiak Wilmington
 Eddie Jonathan Deatherage Danbury
 Beth Ann Dzierzanowski Lumberton
 Linda Gail Harrison Cary
 Perry Allen Saunders Wilmington
 Scott Patrick Simpson Charlotte
 †Pamela Evada Tyndall Asheville

Degrees Conferred May 10, 1986

Jacen William Busick Gibsonville
 *Alfred Eli Cloninger, Jr. Dallas
 Paula Ann Coble Locust
 Carl Esley Crowder, Jr. Reidsville
 *James David Danner Hiddenite
 Tuan Quang Duong Arlington, VA
 †Robert West Graham Burlington
 John Vincente Hankins Greenville
 ***Patrick Earl Hawks Yadkinville
 David Lee Hinson Norwood
 Debbie Patrice Hinton Wendell
 Monica Leigh Jordan Lumberton
 †Katherine Elizabeth Keever Granite Falls
 Laura Christine Kelly Raleigh
 Michael James Knight Lenoir
 Frank Udo Kretzschmar Charlotte
 ***Katherine Marie Kuharcik Wilmington
 *Forrest Gregg McIntosh Charlotte
 Sheryl Ann Northington Greensboro
 ***James Campbell Posey, Jr. Greensboro
 Julia Louise Ross Spartanburg, SC
 *Linda Carol Tomasino Raleigh

BACHELOR OF SCIENCE IN TEXTILE MANAGEMENT

Degree Conferred June 27, 1985

Robert Arthur Smith Mooresville

Degree Conferred August 8, 1985

David Scott Greene Shelby

Degrees Conferred December 17, 1985

Lindsay Rae Beaver China Grove
Susan Elizabeth Bone Raleigh
Daniel Lee Cagle Claremont
James Thomas Cobb Lowell
David Fonso Cooper Fayetteville
Edward Senford Folckomer Burlington
Roger William Hill Clayton
*Adrienne LaFar Gastonia
Donald Lee Lail Conover
William Andrew Long Asheboro
Arthur Rowell Newcombe, IV Gastonia
Jeffrey Todd Rhyne Belmont
Rodney Gene Stamper Sparta
John Herman Stegall Kannapolis
Raymond Bradley Stewart Burlington

Degrees Conferred May 10, 1986

Dorsia Alexander Atkinson, Jr. Landis
Harold Anthony Brown Charlotte
Frank McCormack Canon Albemarle
Richard Hunter Cardwell, Jr. Greensboro
Julie Marie Caudle Statesville
Alan Maurice Chapman Cherryville
Lorre MacGregor Clauss Winston-Salem
David Wayne Coats Raleigh
Robert Andrew Connery, Jr. Charlotte
John Edward Cox, Jr. Dobson
Gregory Hoyt Cranford Troy
Lori Ann Daniel Kannapolis
Tangie Yvette Dyson Durham
William Schaeffer Fisher, Jr. Concord
Elizabeth Southerland Grice Goldsboro
Deborah Denise Hill Forest City
***Cynthia Lynn Hixon Winston-Salem
Daniel Max Huntley Lexington
David Allen Jackson Asheboro
Edward Houston Knox Raleigh
Alison Rhea Lookadoo Morganton
Changsheng Lu Beijing, China
†Euripidea Alicia Marrow Oak City
Matthew Thomas Marshall Wilmington, DE
Marcus Todd McCurry Hickory
Gina Renee Miller Fayetteville
Mohamed Mansour Mohamed Raleigh
William Grimes Mordecai, III Raleigh
Kerry Keith O'Steen Winston-Salem
David Todd Rose Durham
Brian Hugh Turpin Danville, VA
Dwayne Robert Varner High Point
Carmen Lee Waite Raleigh
Tony Morris Wooten Goldsboro

BACHELOR OF SCIENCE IN TEXTILE SCIENCE

Degrees Conferred June 27, 1985

Danny Lee Shields	Greensboro
†Michael Troy Summerlin	Kenansville

Degrees Conferred August 8, 1985

Anne Long Crews	Butner
John Matthew Hurite	Southfield, MI

Degrees Conferred December 17, 1985

Jaleria Gayle Bethel	Kinston
†*Bruce Lewis Butler	Tryon
†Michael Reid Langdon	Fayetteville
†Gwyn Ellen Middleton	Charlotte
Terry Lewis Self	Newton

Degrees Conferred May 10, 1986

Joseph David Atkins	Belmont
Christine White Bissette	Dobson
Karen Lynn Harman	Maiden
†Daron Charles Hyatt	Monroe
Frederick Anthony Jenkins	Bunnlevel
**Caswell Ray Strickland, Jr.	Raleigh
Anthony Roy Yelverton	Zebulon

BACHELOR OF SCIENCE IN TEXTILES

Degrees Conferred August 8, 1985

Abbas Karimianpour	Tehran, Iran
Bharat Patel	Charlotte

Degrees Conferred December 17, 1985

Gary LeVerne Autry	Hope Mills
Richard James Frady, Jr.	Raleigh
Linda Michelle Hoover	Winterville
Cathryn Delynn Jones	Raleigh
Susan Marie Master	Raleigh
Timothy Lee Palmer	Lexington
Tammy Bonnie Rothrock	Greensboro
Amy Susan Winchester	Greenville

Degrees Conferred May 10, 1986

Gina Blackwood Bell	Raleigh
***Kimberly Ann Bolick	Charlotte
*James Michael Britt	Rocky Mount
Velada Yvette Chaires	Springfield, MA
Thomas Allen Fetner	Raleigh
Tammy George Haddad	Knightdale
Jane Amelia Matthews	Stokesdale
***Brian Louis McMurray	Aberdeen
Sharon Lea Morris	Raleigh
Karen Layne Russell	Glen Mills, PA
Boyd Ray Taylor	Hiddenite
Sharon Dale Von Cannon	High Point

†Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

Professional Degrees



MECHANICAL ENGINEER

Degree Conferred December 17, 1985

Fereydoon Souresrafil Tehran, Iran

CIVIL ENGINEER

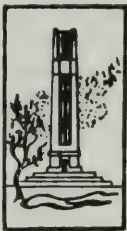
Degree Conferred May 10, 1986

Kirby Robert Bell, Jr. Farmville

†Co-major • Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

GRADUATE DEGREES

Master's Degrees



MASTER OF AGRICULTURE

Degree Conferred August 8, 1985

James Clifton Pollock Kinston

Degrees Conferred December 17, 1985

Richard Frederick May Oriental
Ronnie Wilson Thompson Mocksville

Degrees Conferred May 10, 1986

Peter Thomas Hight Sanford
Jung Yean Joo Seoul, Korea
William Gaston Simmons Seven Springs

MASTER OF ARCHITECTURE

Degrees Conferred December 17, 1985

Emmanuel Abban Philadelphia, PA
Cynthia Crossman Riverside, CT
Thomas Allen Fisher Lubec, ME
Monte Lee Matthews Tarboro

Degrees Conferred May 10, 1986

David Lyles Francis New Bern
Alaaldin Fisal Hason Baghdad, Iraq
James Kent Muirhead Kanata, Ontario, Canada
Brendan Uche Ndukwu Ihiala, Nigeria

MASTER OF BIOMATHEMATICS

Degree Conferred August 8, 1985

Krisna Murti Hasibuan Bogor, Indonesia

Degree Conferred December 17, 1985

William Louis Kendall Cincinnati, OH

MASTER OF CIVIL ENGINEERING

Degrees Conferred August 8, 1985

Steven Andrew Addy Raleigh
Shyh-Chau Chern Taipei, Taiwan, Republic of China
Robert Dale Cooke Westfield
Ting-Hsiung Fang Taipei, Taiwan, Republic of China

Chuu-Train Domihan Leh	Taipei, Taiwan, Republic of China
Talat Masood	Raleigh
Dale Alan Pahl	Durham
Howard Dean Penny	Garner

Degrees Conferred December 17, 1985

Mohammad Bashar Al-Masri	Damascus, Syria
Marian Elizabeth Avera	Winston-Salem
Charng-Chuan Chao	Taipei, Taiwan, Republic of China
Chii-Wha Hwang	Taipei, Taiwan, Republic of China
Gwo-Ruey Hwang	Taipei, Taiwan, Republic of China
Wei-Lien Hwang	Kaohsiung, Taiwan, Republic of China
John Roger Kurfees, Jr.	Statesville
Ralph Andrew Mills	Lexington
Dennis Joseph Murphy	Raleigh
Stephen Charles Nash	Raleigh
Mohd Razman Salim	Kuala Lumpur, Malaysia
Jan Joseph Smith	Cary

Degrees Conferred May 10, 1986

Charles Michael Bullard	Sophia
James Harmon Byrd	Cary
Cheng-Shung Vic Chen	Taipei, Taiwan, Republic of China
Carla Kay Coulson	Hanover, PA
Gina Ann Gilgo	Oriental
John Charles Grey, Jr.	Lexington
Chang Shik Min	Seoul, Korea
Gundiboyana Samuel Eshwar Prasad	Secunderabad, India
David Abbott Ross	Durham
Steven Leslie Thomas	Charlotte
John Allen Kossuth Tucker	Greenville

MASTER OF COMPUTER STUDIES

Degrees Conferred August 8, 1985

Kun-Chen Liu	Taipei, Taiwan, Republic of China
Evelyn Esther Obaid	Perth Amboy, NJ
Raif Oruc Onvural	Istanbul, Turkey
Mark Jay Perry	Raleigh
Shih-Dar Liu Perry	Raleigh
Farooq Ahmad Shah	Srinagar, Kashmir, India
Gina Pei-Ling Tang	Lexington, KY

Degrees Conferred December 17, 1985

Kuang-Wein Hsu	Naperville, IL
Taghi Mohammad Khoshgoftaar	Rasht, Iran
Bou-Chung Lin	Tainan, Taiwan, Republic of China
Phan-Kui Lio	Raleigh
Vellayappan Raman	Raleigh
Douglas John Sedlak	Meadville, PA
Toni O'Steen Sweetland	Jacksonville Beach, FL
Mei-Li Yang	Taipei, Taiwan, Republic of China

Degrees Conferred May 10, 1986

Maria Huey-ming Chao	Laurel, MD
Jeffrey Norman Connolly	Webster, NY
Jing-Shing Hsu	Taipei, Taiwan, Republic of China
Luis Rodolfo Monar	Lima, Peru

Mary Catherine Streble	Winston-Salem
John Angelo Tullo	Wappingers Falls, NY

MASTER OF ECONOMICS

Degrees Conferred August 8, 1985

Lee Anne Britt	Smithfield
Faisal Mustafa Kordi	Taif, Saudi Arabia
Marcus Franklin Phillips	Newton
Lucinda Ayres Thrall	Raleigh
Barry Steven Weinmann	Berkeley, CA

Degrees Conferred December 17, 1985

Gregory Lynn Butler	Roseboro
Steven Wayne Cotton	Angier
Rosa Maria Olivera Fontes	Vicosa, Brazil
Claude Kitchen Futrell II	Apex
Joseph Downing Knisely, Jr.	Bel Air, MD
Heung-Dong Lee	Seoul, Korea
Hartwig Schäfer	Willingshausen, West Germany
Gary Hugh Strickland	Cary

Degrees Conferred May 10, 1986

David Paul Caccamo	Raleigh
Sandra Lee Kafati	San Pedro Sula, Honduras
Andrew Francis Nowel	Wilmington
Sree Kamal Sen	Bombay, India
Julie Ann Stanek	Huntington, WV
Jingyo Suh	Seoul, Korea
Pei-Yu Wang	Taipei, Taiwan, Republic of China

MASTER OF EDUCATION

Adult and Community College Education

Degrees Conferred August 8, 1985

Rebecca Lynette Finch	Rocky Mount
Jimmie Edward Ford	Goldsboro
Hope Willis Hunt	Greensboro
Hector Francis Morales-Chico	Moca, Puerto Rico
William Alfred Underwood III	Asheboro
Saul Wiscovich	Cabo Rojo, Puerto Rico

Degrees Conferred December 17, 1985

Patricia Jean Bailey	Raleigh
James Babson Denny	Wilmington, DE

Degrees Conferred May 10, 1986

Armando Avila	Quebradillas, Puerto Rico
Robert Henry Baker	West End
Sandra Cobb Brown	Plymouth
Irene Adams Brownlee	Raleigh
Theresa Turner Clark	Edenton
Darrel Lynn Conley	Henrietta
Deborah Anita Crandall	Raleigh
Carolyn Davis	Nashville
Kenneth Norman Egan	Melbourne, Australia
Landis Forestier	Mayaguez, Puerto Rico
Eduardo Garcia	Santurce, Puerto Rico

Charles Emory Hammond	Linden
Haywood Eugene Harrell	Ahoskie
William Powell Kemp, Jr.	Goldsboro
Georgia Upton Kight	Maple
Nancy Jane Greeson Lackey	Lenoir
Lucy Bennison Laffitte	Tallahassee, FL
Arleshia Hooks Monroe	Wilson
Carlos Alberto Nazario-Pagan	Cabo Rojo, Puerto Rico
Joan Annette Parker	Durham
Patricia Mae Pearsall	Goldsboro
James Lee Peele	Powellsville
Antony Edwin Queen	Raleigh
Linda Keith Ray	Winston-Salem
Phillip Ray Ricks	Smithfield
Donald Gerald Sauls	Dunn
Milford Rodney Sawyer, Jr.	Barco
Connie Adams Sherrill	Tarboro
Helen Napier Thomas	Greensboro
William Gerald Waters, Jr.	Raleigh
Lois Phelps Williams	Bakersville

Agricultural Education

Degrees Conferred August 8, 1985

Kenneth Earl Rogers	Denton
Elizabeth Bundy Wilson	Whitakers

Degrees Conferred December 17, 1985

Hallet Swinson Davis, Jr.	Jamesville
Benjamin Dixon Forrest III	Grimesland
Dale Sullivan Lamb	Rutherfordton
Stephen Denning Tart	Goldsboro

Degree Conferred May 10, 1986

Gerald Keith Barlowe	Roanoke Rapids
----------------------	----------------

Curriculum and Instruction

Degree Conferred December 17, 1985

Celeste Honeycutt Blankenship	Garner
-------------------------------	--------

Degree Conferred May 10, 1986

Teresa Marie Sicher	Carrboro
---------------------	----------

Educational Administration and Supervision

Degrees Conferred May 10, 1986

Jerome Richard Cordts	Frostburg, MD
Harriet Lorraine Lasher	Raleigh

Guidance and Personnel Services

Degrees Conferred August 8, 1985

Sherry Strowd Andrews	Pittsboro
Todd Juan Dorsey	Shelby
Charles Rupert McAdams III	Charlotte
Thomas Oren Richards	Seattle, WA

Degrees Conferred December 17, 1985

Jane Midgett Butler	Raleigh
Meredith DeLa Vergne	Raleigh
Athena LaRue Neblitt	Portsmouth, VA
Artura Chekong Ritter	Raleigh
Jacqueline O'Neill Velasco	Boulder, CO

Degrees Conferred May 10, 1986

Polly Fussell Addison	Raleigh
Tanyer Clark Andrews	Emporia, VA
Marsha Ellise Boyd	Washington
Karen Eileen Brill	Woodstock, VA
Susan Harris Frazier	Oxford
Susan Campbell Hodges	Washington
Elizabeth Hardison Howard	Oxford
Margaret Karen Joyner	Wilmington
Martha Sofield Dandridge Overton	Martinsville, VA
Sandra Kovach Shahady	Chapel Hill
Gloria McCallister Williams	Raleigh

Industrial Arts Education

Degree Conferred August 8, 1985

Annemarie Holthe Estep	Fayetteville
------------------------------	--------------

Degree Conferred December 17, 1985

Norman Eugene Gossett	Durham
-----------------------------	--------

Degree Conferred May 10, 1986

Willie Fred Edmonds	Raleigh
---------------------------	---------

Mathematics Education

Degree Conferred August 8, 1985

Katherine Lee Mayberry	Winston-Salem
------------------------------	---------------

Degree Conferred May 10, 1986

Faye Laverne Massey Thornton	Raleigh
------------------------------------	---------

Middle Grades Education

Degree Conferred December 17, 1985

Mary Mac Lucas	Louisburg
----------------------	-----------

Degree Conferred May 10, 1986

Margaret Handy Krabill	Raleigh
------------------------------	---------

Occupational Education

Degree Conferred August 8, 1985

Gloria Huss Peele	Sanford
-------------------------	---------

Degrees Conferred December 17, 1985

Donald Harry Damon	Lillington
Linda Roof Walston	Goldsboro

Degrees Conferred May 10, 1986

Wittonia Daniel Arrington	Raleigh
Anne Riddick Carroll	Raleigh
Jane Agner Salmon	Durham

Science Education

Degrees Conferred August 8, 1985

Robert Michael Patterson	Fayetteville
LeVonda Stephenson Ritchie	Angier

Degrees Conferred December 17, 1985

John Milton Davis	Raleigh
Michelle Anne Marquis	Poughkeepsie, NY

Degree Conferred May 10, 1986

Edwin Bailey Dunlap	Walnut Cove
---------------------------	-------------

Special Education

Degree Conferred August 8, 1985

Patricia Dianne Barker	New Bern
------------------------------	----------

Degrees Conferred December 17, 1985

Melanie Helms Hurley	Wendell
Nancy Kay Lynch Nettles	Princeton
Melissa Lynn Arnold Noll	Durham
Mabel Lee Page	Godwin
Carol Fowler Weaver	Fuquay-Varina

Degrees Conferred May 10, 1986

Joan Meyer Baker	Raleigh
Anne Price Dailey	Cary
Cynthia Greyson Darden	Charlotte
Steven Andrew Erickson	Pittsboro
Cynthia Anne Whitenack Kidd	Raleigh
Sara Fountain McKee	Charlotte

MASTER OF ELECTRICAL AND COMPUTER ENGINEERING

Degree Conferred May 10, 1986

*Guey-Ruey Lee	Ping-Tong, Taiwan, Republic of China
----------------------	--------------------------------------

MASTER OF FORESTRY

Degrees Conferred May 10, 1986

Stephen Richard Moore	Asheville
John Bernard Tansey	Asheville

MASTER OF INTEGRATED MANUFACTURING SYSTEMS ENGINEERING

Degrees Conferred August 8, 1985

James Deal Alexander	Raleigh
William Durward Gregory, Jr.	Cary
Mark Kevin Nelson	Coushatta, LA

*Co-major in Mechanical Engineering. See page 82.

Degree Conferred December 17, 1985

Scott Richard Schultz Palm Beach Gardens, FL

Degrees Conferred May 10, 1986

Keith Edward Baldwin Plantation, FL
Brian Charles Monahan Rockville, MD

MASTER OF LANDSCAPE ARCHITECTURE

Degrees Conferred August 8, 1985

Steven Fuhrman Brooklyn, NY
James Richard Wike Raleigh

Degrees Conferred December 17, 1985

Wiley J'Nell Bryson Pineville
Colleen Eleanor Carl Warren, MI
Daniel Anthony Howe Saint Louis, MO
Karin Rita Kaiser Raleigh
James Gray Strupe, Jr. Winston-Salem
William Thomas Welsh Saint Louis, MO

Degrees Conferred May 10, 1986

Jeffrey David Adolphsen Fulton, MD
Lorayne Carol Algren Manchester, CT
Catherine Ann Alguire Raleigh
Brenda Arlene Barclay Brooklyn, NY
Cheryl Herlache Dorney Green Bay, WI
Jeffrey Burr Evans Harrisburg, PA
Peter Collins Gormley Bradenton, FL
Sherold Drake Hollingsworth Winston-Salem
Ronald Verner Johnson Hyannis, MA
Wendy Jayne Miller Rockville, MD
Timothy Rusch Newell Wilmington
Michael Jay Nisenbaum Jericho, NY
Lisa Kay Schicker Raleigh
Sharron Cathey Scroggin Eutaw, AL
Dorothy Christy Snipes Fayetteville
Mary Ackerman Staab Chapel Hill
Daphne Ann White Ponca City, OK

MASTER OF LIFE SCIENCES

Degree Conferred August 8, 1985

Irving Sullivan-Douhr Raleigh

Degrees Conferred December 17, 1985

Ronald Gray Rogers Raleigh
Sylvia Darlene Whitworth Gastonia

Degrees Conferred May 10, 1986

Mary Theresa Butler Salem, MA
Farzahan Memari Ahwaz, Iran

MASTER OF MATERIALS ENGINEERING

Degree Conferred August 8, 1985

Yvan Christopher Eckert Lempdes, France

Degree Conferred May 10, 1986

Daniel Webster Brinkley III Lexington

MASTER OF MECHANICAL ENGINEERING

Degrees Conferred August 8, 1985

Sharon Burns Cash Fayetteville
Stanley Vernard Cash Morven
Philip Conrad Graves Hickory
Marky Alan Liles Zebulon
George Ambler Sagar Asheville

Degree Conferred December 17, 1985

Ke-Jun Xie Shanghai, People's Republic of China

Degrees Conferred May 10, 1986

Hossein Eshraghi Tehran, Iran
Imad Mohammad Knio Beirut, Lebanon
*Guey-Ruey Lee Ping-Tong, Taiwan, Republic of China
Karla Robinson Charlottesville, VA
David Franklin Rowe, Jr. Clemmons
Mohammad Ali Sarrafian Abadeh, Iran
Eric Hartley Stokes Durham
Walter Lee Willard Oak Ridge

MASTER OF NUCLEAR ENGINEERING

Degree Conferred May 10, 1986

Uma Shankar Mayavaram, India

MASTER OF PRODUCT DESIGN

Degree Conferred December 17, 1985

Bonny Mendenhall Calloway Wake Forest

Degrees Conferred May 10, 1986

James Eric Barefoot Raleigh
Paul Robert Dean Raleigh
Bryan Whitfield Laffitte Tallahassee, FL
Kene Juen-Yuan Lin Taichung, Taiwan, Republic of China
Carolyn Ugran Solomon Raleigh
Theodore Nicholas Van Dyk Potomac, MD
Susan Elaine Von Cannon Archdale
Bruce Williams Whipple Winston-Salem

MASTER OF PUBLIC AFFAIRS

Degrees Conferred August 8, 1985

Linda Dale Briggs Butner
Wesley Brent Davis Winston-Salem
Charles Ernest Horne Stedman
James Everett Nichols Raleigh
Paula Louise Nicholson Enfield
Kennon Forrest Privette Zebulon
Linda Christine Sewall Raleigh
Kathleen Reynolds Wright Charlotte

*Co-major in Electrical and Computer Engineering. See page 80.

Degree Conferred December 17, 1985

Douglas Harold Cox Burlington

Degrees Conferred May 10, 1986

Paula Kozicki Few East Orange, NJ
William Allen Fleming Clinton
Steven Lyerly Lusk Charlotte
Pamela Jean Majette Murfreesboro
Jesse Thomas Pugh III Asheville
Sharon Kay Stokes Raleigh
Willie Catherine McDonald White Durham
Beverly LaVaughn Williams Gastonia
Danielle Kay Withrow Jacksonville, FL

MASTER OF RECREATION RESOURCES

Degree Conferred August 8, 1985

William Francis Walsh Freehold, NJ

Degrees Conferred December 17, 1985

Arthur Frank Buzzard, Jr. Benson
Ana Damaris Castillo Caracas, Venezuela
**Eugene Raymond Tomlinson Raleigh

Degrees Conferred May 10, 1986

Judith Ann Cauterucci Westfield, NJ
Michael Anthony Dixon Scotland Neck
**David Kyle Donnally, Jr. Durham
Jo Anna Lilley Williamston

MASTER OF STATISTICS

Degrees Conferred August 8, 1985

Cheng Wen Robert Chu Kaoshung, Taiwan, Republic of China
Karen Arnold Nelson Sanford
Timothy Gregory O'Brien Ashtabula, OH
Mee Lee Wan Yeun Shing Rose-Hill, Mauritius

Degrees Conferred December 17, 1985

Ming-Chun Chang Yung-Ho, Taiwan, Republic of China
David Creighton Cooper Butler, PA
Kathleen Galante Haynes Raleigh
Farid Kianifard Tehran, Iran
Janice Ruth Stone Lansing, MI

Degrees Conferred May 10, 1986

Jae Ho Cho Seoul, Korea
Joshuah Makore Harare, Zimbabwe
Clinton Thomas Moore Decatur, GA
Mark S. Udevitz Denver, CO
Scott Richard Winterstein Las Cruces, NM

MASTER OF TEXTILES

Degree Conferred August 8, 1985

Marguerite Anna Reed Media, PA

** (Co-major: Public Affairs)

Degree Conferred December 17, 1985

Wei Li Shanghai, People's Republic of China

Degree Conferred May 10, 1986

Suresh Kimar Sus Willow Springs

MASTER OF TOXICOLOGY

Degree Conferred August 8, 1985

Mark Alan Higuchi Uniondale, NY

MASTER OF WOOD AND PAPER SCIENCE

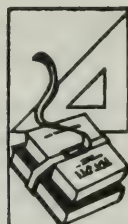
Degree Conferred December 17, 1985

John Francis Lyons New Bedford, MA

Degree Conferred May 10, 1986

Mohammad Yasin Peshawar, Pakistan

Master of Arts Degrees



Archival Management

Degrees Conferred August 8, 1985

Victor Dale Nielsen	Zebulon
Adrienne Kerry Strong	Exeter, VA

Degree Conferred December 17, 1985

Alexandra Susan Gressitt	Battle Ground, WA
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Degree Conferred May 10, 1986

Dorothy Tuttle Frye	Decatur, GA
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Economics

Degree Conferred May 10, 1986

Richard Don Skillen	Garner
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English

Degree Conferred August 8, 1985

Karen Joy Bartlett	Raleigh
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Degrees Conferred December 17, 1985

Katherine Pittman Hayes	Wilson
Roy Ray Moye, Jr.	Raleigh

Degrees Conferred May 10, 1986

Biman Basu	Calcutta, India
Constance Lee Sowell	Raleigh

History

Degrees Conferred August 8, 1985

Norman Alexander Miller III	Wilmington
William Walter von Hausen	Cary

Degree Conferred December 17, 1985

Betty K. Frees Vaughan	Garner
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Degrees Conferred May 10, 1986

Clay Shepard Griffith	Raleigh
Janet Gail Stone-Erdman	Green Cove Springs, FL

Political Science

Degree Conferred August 8, 1985

John Bower Boone	Raleigh
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Degree Conferred December 17, 1985

Roland Spencer Lane Fayetteville

Degrees Conferred May 10, 1986

Ioane Keehu, Jr. Honolulu, Hawaii
Frank Moore III Huntington, NY
James Walter Tompkins Watervliet, NY

Master of Science Degrees



Adult and Community College Education

Degrees Conferred May 10, 1986

Catherine Benton Barham	Youngsville
Lois Riddle Carter	Knightdale
Puangpaga Jantrasurin	Long Prae, Thailand

Aerospace Engineering

Degrees Conferred May 10, 1986

Dean Robert Eklund	Hendersonville
Richard Irvin Kreis	Glen Ellyn, IL
Robert Alan Mitcheltree	Charlotte

Agricultural Economics

Degree Conferred May 10, 1986

Elizabeth Frazao	Cary
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Agricultural Education

Degree Conferred August 8, 1985

Marie Ellen Schroeder	West Islip, NY
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Animal Science

Degrees Conferred May 10, 1986

Karen Louise Davis	Long Beach
Robert Francis Jarman	Burlington
Gary Wayne Rogers	New Market, TN

Biochemistry

Degrees Conferred May 10, 1986

Lynette Bryant	Wilmington
Rick Thomas Dobrowsky	Pittsburgh, PA
Margaret Rose Sutherland-Smith	Raleigh

Biological and Agricultural Engineering

Degrees Conferred December 17, 1985

Keith Harding Dunlevy	Syringa, VA
Edward Joseph McCarthy	Raleigh
Aihua Song	Hebei, People's Republic of China

Degrees Conferred May 10, 1986

Marjorie Smith Davenport	Shelburne Falls, MA
Sharon Zelmanowitz	Bronx, NY

Botany

Degrees Conferred August 8, 1985

Donna Sapp Fabric	Raleigh
Angel Leal	San Tome, Venezuela
Jeffery Jerome Wheeler	Raleigh

Degrees Conferred December 17, 1985

Paul William Leadley	State College, PA
Doris Irletha Ravenell	Cross, SC

Degrees Conferred May 10, 1986

Robert John Kodrzycki	Boston, MA
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Chemical Engineering

Degrees Conferred August 8, 1985

Yuan-Ching Hsieh	Tauyuan, Taiwan, Republic of China
Jae Youn Kim	Raleigh
Maria Ragland	Detroit, MI

Degrees Conferred December 17, 1985

Adel Kassebi	Astrar, Iran
Henry Frederick Oehler III	Myrtle Beach, SC

Chemistry

Degree Conferred August 8, 1985

Douglas Kirk Wilbourne	Cary
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Degree Conferred December 17, 1985

Itzela Daisy Correa	Fayetteville
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Degrees Conferred May 10, 1986

Lisa Hirsch Askari	Newtown, PA
William Keith Personette	Fayetteville
Scott Charles Smith	Greensboro

Civil Engineering

Degrees Conferred August 8, 1985

Shinchen Fuh	Taipei, Taiwan, Republic of China
James Jeffery Howard	High Point

Degrees Conferred December 17, 1985

John Alan Henry	Conover
Cynthia Cunningham Lancaster	New Bern
Jeffrey Glenn Shelden	Raleigh

Degrees Conferred May 10, 1986

John Hershey Fogarty	Hickory
James Kenneth Johnson	Fayetteville
Wesley Martin Lowder	Albemarle

Vasilios Constantin Parathiras	Athens, Greece
Richard Charles Romano	Somerdale, NJ
Michael Anthony Young	Lexington

Computer Studies

Degrees Conferred August 8, 1985

Zahara Amir	Colombo, Sri Lanka
Llewellyn Bradley Marshall IV	Springfield, VA
Phillip Lloyd Shaffer	Raleigh
Chien-En Sun	Taipei, Taiwan, Republic of China
Mladen Alan Vouk	Zagreb, Yugoslavia
Stephen Gardner Worth III	Reidsville

Degrees Conferred December 17, 1985

Richard Harold Carver	Mansfield, OH
Chao-Tun Din	Taipei, Taiwan, Republic of China
James Edward Gary	Louisville, KY
John Edward Rose	Cary
Ramasubramanian Suresh	Melur, Madurai, India
Van Allen Wheeler	Raleigh

Degree Conferred May 10, 1986

Joachim Schluter	Grunstadt, West Germany
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Crop Science

Degrees Conferred August 8, 1985

Edmundo Felix Felipe	Maracay, Venezuela
Wahab Bin Ismail	Trengganu, Malaysia
Kamariah Bt Mohamed	Kota Bharu, Kelantan, Malaysia
Alton Earl Wood, Jr.	Clayton

Degrees Conferred December 17, 1985

Christine Louise Bergmark	Raleigh
Ralph Earl Dewey	Logan, UT
Frederick McKinney Fishel	Roanoke Rapids
Tracy Michelle Halward	Miami, FL

Degrees Conferred May 10, 1986

Yahya Bin Awang	Kuala Trengganu, Malaysia
Richard Manly Edmund, Jr.	Chadbourn
Ralph Burkhead Lassiter, Jr.	Durham
Elizabeth Hurst MacDonald	Raleigh
Jerry Michael Moore	Kinston
John Jeffrey Mullahey	Raleigh
Eric Kavin Rawls	Raleigh
Samba Traore	Faraba-Guimba, Mali
Mark Edward Zarnstorff	Waukesha, WI

Educational Administration and Supervision

Degree Conferred August 8, 1985

Teresa Crocker Allsbrook	Raleigh
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Electrical and Computer Engineering

Degrees Conferred August 8, 1985

Martin Andrew Burkhardt	Lexington
Chandra P. Chaudhari	Wappingers Falls, NY
Jin-Hur Wang	Taipei, Taiwan, Republic of China

Degrees Conferred December 17, 1985

Adnan Mohammed Alattar	Khanyounis, Israel
Kam Wing Chai	Kowloon, Hong Kong
Hsien-Tung Chang	Taichung, Taiwan, Republic of China
Arvind Kumar Singh Chaudhary	Bangalore, India
Wen-Rong Chuang	Taipei, Taiwan, Republic of China
Jerry Dagher	Kalamazoo, MI
Carl Wesley Douglas	Wendell
Bruce Alan Gieseke	Morrow, OH
Magnus Hartmann Gislason	Reykjavik, Iceland
Joseph Herbert Greene	Charlotte
Ronald Lee Griffin	Raleigh
Chaw-Chia Huang	Chia Yi, Taiwan, Republic of China
Laura Ann Israel	Spartanburg, SC
Georgios Vassilios Karras	Charlotte
Edmond Burl Keith	Columbia, SC
Mohammed Ahmad Khasawneh	Amman, Jordan
Hyun-Mun Kim	Seoul, Korea
Ching-Hui Su	Taipei, Taiwan, Republic of China
Michael Daniel Todd	Wilmington
Jeffrey Kent Whisnant	Greensboro
Deborah Jean Zanella	Raleigh

Degrees Conferred May 10, 1986

Nadeem Ahmed	Karachi, Pakistan
Randy Keith Avent	New Bern
Daniel Charles Borowski	Niles, IL
Ji-En Chang	Taipei, Taiwan, Republic of China
Lianjaw Chen	Chungli, Taiwan, Republic of China
Tein-Yaw David Chung	Tao-Yuan, Taiwan, Republic of China
Clarence Jerry Decker	Pine Bush, NY
Mahesh Pravinchandra Desai	Ahmedabad, India
David Lane Dreifus	Philadelphia, PA
Chung-Sing Ho	Hong Kong
Yeong-Shiou Hsiao	Hsinchu, Taiwan, Republic of China
Edward Kuangyao Huang	Cary
Kuojim Huang	Taichung, Taiwan, Republic of China
Kuo-Chung Ju	Taipei, Taiwan, Republic of China
Joseph Toufic Khalife	Beirut, Lebanon
Chaiyaporn Komolkiti	Bangkok, Thailand
Shu-Sung Ku	Taipei, Taiwan, Republic of China
Pei Yeou Li	Taichung, Taiwan, Republic of China
Lan-Chien Luo-Hsueh	Cary
Thomas Nicholas Mathes	Winston-Salem
Gee-Gwo Mei	Taipei, Taiwan, Republic of China
Nikolaos Ilias Papageorgiou	Charlotte
Nikunja Kishore Swain	Cuttack, India

Marwan Tarabichi	Damascus, Syria
Murdock Clyde Taylor III	Raleigh
Ming-Zuan Tsai	Taipei, Taiwan, Republic of China
Evangelos Dimitrios Tzathas	Athens, Greece
Samuel Jacob Wallin	Huntersville
Atef Omar Zaghoul	Cary

Electrical Engineering

Degrees Conferred August 8, 1985

Leo Robert Blume	Fayetteville
George Michael Calhoun	Raleigh
Gung-Shih Chien	Panchiao, Taiwan, Republic of China
Thomas Henry Hildebrandt	Raleigh
John LeRoy Pierce	Hillsborough
George William Rhyne	Hickory

Degrees Conferred December 17, 1985

Nelson Brady Johnson	Statesville
Yawcheng Lo	Taipei, Taiwan, Republic of China

Degree Conferred May 10, 1986

Douglas Bryan Guy	Jacksonville
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Entomology

Degree Conferred December 17, 1985

Carl William Kollmer	Fayetteville
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Food Science

Degree Conferred August 8, 1985

Kimberly Ann Kirschenman	Winston-Salem
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Degrees Conferred December 17, 1985

Melissa Charlene Joerger	Tigard, OR
Philip Allen Rakes	Raleigh
Wesley Davis Sing	Indianapolis, IN

Degrees Conferred May 10, 1986

Frank Bryan Edwards	Greer, SC
David Loren Fish	Raleigh

Forestry

Degree Conferred August 8, 1985

Michelet Fontaine	Port-au-Prince, Haiti
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Degrees Conferred December 17, 1985

James Floyd Hodges	Boone
Carrie Denise Ingram	Wilkesboro
Efrain Antonio Lao	Las Minas, Herrera, Panama
Sunil Kumar Nepal	Hetauda, Nepal
Mary Young Rice	Raleigh

Degrees Conferred May 10, 1986

Stanley Morris Dunston	Raleigh
Patrick Bryan Durst	Richland Center, WI
Leslie Wolfinger Ledogar	Brunswick, GA
Bailian Li	Beijing, People's Republic of China
Patrick Daniel Pelkey	Raleigh

Guidance and Personnel Services

Degree Conferred May 10, 1986

Martha Damaris Marks	Greenville, SC
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Horticultural Science

Degrees Conferred August 8, 1985

Barbara Katherine Cohea Pitmen	Albuquerque, NM
Jacqueline Anne Ricotta	Rochester, NY
Mark Stephen Strefeler	Canonsburg, PA

Degrees Conferred December 17, 1985

Laura Joan Lehman	Girard, PA
James Davis Tomlinson	Wilkesboro

Degree Conferred May 10, 1986

Jennifer Ann Werner	Bethlehem, PA
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Industrial Engineering

Degrees Conferred August 8, 1985

James Christopher Culbreth	Greensboro
Edward Hardy Frazelle	Raleigh
Kwan-heng Lee	Seoul, Korea
Anne Coward Lindsey	Canton

Degrees Conferred December 17, 1985

Robert Lenox Almond III	Raleigh
Rebecca Jane Jones	Kittrell
Patricia Martin Kinney	Wrightsville, PA
Gregory Clarke Raber	Asheville
Alex John Thompson	Winston-Salem

Degrees Conferred May 10, 1986

Rajesh V. Bhatt	Ahmedabad, India
John B. Davis III	Cary
Joseph Randall Davis	Raleigh

Management

Degrees Conferred August 8, 1985

Hector Manuel Bird	Cary
Laxminarayana Gopal Iyengar	Raleigh
Sharlene Joyce Nordblom Rickert	Davenport, IA
Harold Williams Wright	Liberty

Degrees Conferred December 17, 1985

Stanley Boleslaw Andrzejewski	Raleigh
Bradley Benton Blackwelder	Charlotte
Sanath Chandralal Jayanetti	Welikada, Sri Lanka

Marcia Lynn Bowen Ramirez	Raleigh
Karen Jean Ulberg	Raleigh

Degrees Conferred May 10, 1986

Swadesh Bandhad Chatterjee	Raleigh
Bahman Dorafshar	Tehran, Iran
Jennie Maria-Nora Freeman	Raleigh
Nur Mevlude Onvural	Ankara, Turkey
Shane Grayson Phillips	Rockingham
Lindsay Earl Rogers	Taylorsville
Shubhang Madanmohan Shah	Ahmedabad, India

Marine, Earth and Atmospheric Sciences

Degrees Conferred August 8, 1985

Lewis Edward Gilbert	Falmouth, MA
Germaine Philomena Johnson	New Orleans, LA

Degrees Conferred December 17, 1985

Clark Raymond Alexander, Jr.	LaVerne, CA
Brian James Bellis	Wantagh, NY
Robert David Blevins	O'Fallon, IL
Cricket Corwin	Yorktown Heights, NY
Caroline Virginia Johnson	Daytona Beach, FL
James Thomas Kroll	Cary
Robert Mulvihill Lent	McLean, VA
Richard Bowen McKinney	Raleigh
James Sherwood Meade	Alexandria, VA
Jonathan Andrew Powers	Cary
Hendrik Jan van der Meyden	Virginia Beach, VA

Degrees Conferred May 10, 1986

Nancy Anne McMichael Berdasco	Midland, WI
Richard Edward Bolich	Elkin
John Laurence Daw	Chapel Hill
Gary Jay Kirkpatrick	Meadville, PA

Materials Engineering

Degrees Conferred August 8, 1985

Stanley Kiser Hovis	Lowell
Charles Eric Hunter	Boone
Karren Leslie More	Raleigh
Poonthavee Sujjayakorn	Bangkok, Thailand

Degrees Conferred December 17, 1985

Sarwan Kuman Mannan	Amritsar, India
Robert David Nixon	Charlotte
Michael James Paisley	Garner

Degrees Conferred May 10, 1986

Charles Richard Manning III	Raleigh
Attibele Ramaswamy Shamala	Bangalore, India

Mathematics

Degree Conferred August 8, 1985

Hongde Liu	Spruce Pine
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Mathematics (Applied)

Degrees Conferred August 8, 1985

Peggy Jo Grady Batten	Kenly
Doris Elizabeth Bell	Bonaire, GA
James Robert Buchanan	Sanford
Renita Jo Gammons	Mount Airy
Benjamin Edward Hoyle	Lenoir
Joy Lynn Matthews-Lopez	Roanoke Rapids
Mitchelle Elizabeth Spivey	Charleston, SC

Degrees Conferred December 17, 1985

Mohd Rizam Abu Bakar	Kuala Trengganu, Malaysia
Richard Plocker Haney	Greensboro
Richard Donnell Havnaer	Hickory
Frederick Deon Johnson	Elizabethtown

Degree Conferred May 10, 1986

Timothy John Sakulich	Lake Orion, MI
-----------------------------	----------------

Mathematics Education

Degree Conferred August 8, 1985

Barbara Ann Soloman	Wake Forest
---------------------------	-------------

Mechanical Engineering

Degrees Conferred August 8, 1985

Omeed Alahverdizadeh	Raleigh
Shih-Emn Chen	Keelung, Taiwan, Republic of China
Daniel William Dickey	Rutherfordton
Steven Chris Holhubner	Olmsted, IL
Keith Floyd Medlin	Charlotte

Degrees Conferred December 17, 1985

Walter Edward Bruce III	Grafton, VA
Michael Craig Goff	Lawrenceberg, KY
David Hamrick Howerton	Raleigh
John Ervin Keever	Granite Falls
***Thomas Joseph Luckenbach	Cuyahoga Falls, OH
Kenneth Trent Ryals	Columbia, MD
Jody Michael Shuping	Salisbury
Gail Louise Taylor	Dunbarton, NH

Degrees Conferred May 10, 1986

Christopher Mark Cagle	Rockingham
Donald Keith Clarke	Mount Olive
Dong-Hyun Kim	Seoul, Korea
Mark Stephan Landy	Raleigh
Frank Teague Wagner, Jr.	Raleigh

Microbiology

Degree Conferred August 8, 1985

Barbara Ann Sawyer	Raleigh
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***Co-major in Operations Research. See page 95.

Degree Conferred December 17, 1985

William Mark Barbour Collinsville, VA

Degrees Conferred May 10, 1986

Julie Ann Barnes Trenton, MI

Leslie Cheryl Hancock Augusta, GA

Nuclear Engineering

Degree Conferred August 8, 1985

Salman Ul Haq Islamabad, Pakistan

Degree Conferred December 17, 1985

Donald Christoph Krupp Cicero, NY

Degree Conferred May 10, 1986

Mary Robin Holliday Raleigh

Nutrition

Degree Conferred December 17, 1985

****Terri Kay Leeming Rockford, IL

Occupational Education

Degree Conferred August 8, 1985

Beverly Joyce Baird Marietta, GA

Operations Research

Degree Conferred December 17, 1985

***Thomas Joseph Luckenbach Cuyahoga Falls, OH

Degree Conferred May 10, 1986

Gerald Wallace Shapiro Miami, FL

Physiology

Degrees Conferred August 8, 1985

Jerry Glen Ballard, Jr. Gastonia

Edward Thomas Chappell Elizabeth City

Degrees Conferred May 10, 1986

*****Barbara Lee Wright Fouse Aliquippa, PA

Thomas Bruce Grizzle Chapel Hill

Plant Pathology

Degrees Conferred August 8, 1985

Cynthia Jo Cooperman Kensington, MD

Nancy Sherwood Hill Harrisburg, PA

Sandra Meier Cohoes, NY

***Co-major in Mechanical Engineering. See page 94.

****Co-major in Toxicology. See page 98.

*****Co-major in Toxicology. See page 98.

Degrees Conferred December 17, 1985

Diane Gail Alston	Montclair, CA
Jennifer Armen	Newport, NH
Janet Lynn Salzwedel	Whitewater, WI

Degree Conferred May 10, 1986

William Otho Cline	Rutherfordton
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Poultry Science

Degree Conferred December 17, 1985

Mian-Rong Lee	Taipei, Taiwan, Republic of China
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Degree Conferred May 10, 1986

Patricia Ann Voegelé	Winston-Salem
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Psychology

Degrees Conferred August 8, 1985

Herbert Wilson Campbell	Elm City
Kristin Clark Dougherty	Washington, DC
Katherine Ann Grant	Cary
Mary Lynn Hyte	North Charleston, SC
Lesa Cherry Lindsay	Gallatin, TN

Degrees Conferred December 17, 1985

Ann Vaughn Clark	Fayetteville
MarySue Hay	Hendersonville
Michael Lamonte Headen	Brown Summit
Donald Lynn Ivey	Lumberton
Leslie Walker Joyce	Charlotte
Claire Fisher Patterson	Durham

Degrees Conferred May 10, 1986

Teresa Regina Gidley	Orange Village, OH
Gregory William Hill	Morganton
William Edward Hutson	Bowie, MD
Alex Dudley Little	Raleigh
Mary Ann Olsen	Raleigh

Recreation Resources Administration

Degrees Conferred August 8, 1985

Dean Frederick Tucker	Natick, MA
Julie Ann Winters	Kansas City, KS

Rural Sociology

Degree Conferred May 10, 1986

James Alton McKenzie	Mooreville
----------------------------	------------

Soil Science

Degrees Conferred August 8, 1985

Lisa Marie Hajjar	Goldsboro
Peter Calvin Rohman	Raleigh

Degree Conferred December 17, 1985

Laurie Jill Newman Elkins Park, PA

Degrees Conferred May 10, 1986

Nagwa Bashir Elsaied Port Sudan, Sudan
Richard Wayne Griffin Elizabeth City
David Herring Hardy LaGrange

Special Education

Degree Conferred May 10, 1986

Sharon Martha Toplak Kruck Chapel Hill

Statistics

Degree Conferred December 17, 1985

Peter Njuho Mungai Kikuyu, Kenya

Degree Conferred May 10, 1986

Joseph Koula Abidjan, Ivory Coast

Textile Chemistry

Degree Conferred August 8, 1985

Kevin Wesley Throneburg Newton

Degrees Conferred December 17, 1985

Gao-Yuan Chen Funing, Jiangsu, People's Republic of China
Quentin Lee Kampf Walpole, MA
Han Sup Lee Inchon City, Korea

Degrees Conferred May 10, 1986

Sharon Scott Geier Durham
Whei-Neen Hsu Taipei, Taiwan, Republic of China
Brenda Leigh Kelly Garner

Textile Engineering and Science

Degrees Conferred December 17, 1985

Sabit Andanur Istanbul, Turkey
Abhijit Anant Marathe Miraj, India

Degree Conferred May 10, 1986

Gail Suzette Holden Luckey Louisburg

Textile Management and Technology

Degrees Conferred December 17, 1985

Martin Blake McKinnon Clayton
Alesia McKinnon Talley Clayton

Textiles

Degree Conferred August 8, 1985

Bill Lester Milam, Jr. Kannapolis

Degree Conferred December 17, 1985

Doyle Kiser NeedhamAsheboro

Toxicology

Degree Conferred August 8, 1985

Rita Helen NeillCroton-on-Hudson, NY

Degrees Conferred December 17, 1985

Stanley Thomas AtwoodBoone

****Terri Kay LeemingRockford, IL

Susan Adria MeyerBoynton Beach, FL

Kathleen Edith MooreFairfield, CT

Degrees Conferred May 10, 1986

Michael Anthony CarbonaroMount Holly, NJ

****Barbara Lee Wright FouseAliquippa, PA

Veterinary Medical Sciences

Degree Conferred August 8, 1985

Cynthia Sue CookApex

Wildlife Biology

Degree Conferred December 17, 1985

Roberta Jo BlueHigh Point

Degrees Conferred May 10, 1986

Walter Alan PursleyGastonia

Jimmy Jay ReynoldsOxen Hill, MD

Wood and Paper Science

Degree Conferred August 8, 1985

David Klopp SeylerRobesonia, PA

Degrees Conferred December 17, 1985

Henry Tilmon CoreyGreenville

Jian Er JiangGuangdong, People's Republic of China

Marcos A. E. SantanaBrasilia, D. F., Brazil

Nam Hee ShinSeoul, Korea

Degree Conferred May 10, 1986

Wey-Rehm WangTaipei, Taiwan, Republic of China

Zoology

Degree Conferred August 8, 1985

Martha Irene BarnesBirmingham, MI

Degrees Conferred May 10, 1986

Judi Lee DurdaBrownsville, PA

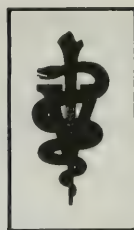
Mary Katherine HeckHendersonville

Jeff Mark PhillipsRaleigh

****Co-major in Nutrition. See page 95.

*****Co-major in Physiology. See page 95.

Doctor of Veterinary Medicine



SCHOOL OF VETERINARY MEDICINE

Degrees Conferred May 10, 1986

John Tyler Bingham	Maiden
Ted Anthony Broome	Monroe
Mary Katherine Burdick	Robersonville
Kathryn Walecka Bush	Raleigh
John Mark Cline	Rutherfordton
Rebecca Ann Cockman	Greensboro
Pamela Ruth Deason	Asheville
Katherine Jennifer DeVore	Gray's Creek
Mary Hilda Fluke	Durham
Deborah Susan Fox	Jacksonville
Elizabeth Bradley Fuhrmann	Raleigh
Sarah Young Gardner	Charlotte
Maxine Ruth Gilvey	Cary
Joseph Keith Gordon	High Point
Karen Elizabeth Gunter	Durham
Olivia Patricia Guzman	Fayetteville
Tracy Leon Hanner	Bear Creek
Melanie Anne Harper	Winston-Salem
David Joseph Henzler	Kinston
Cathi Jane Holden	Hendersonville
Gail Connette Hoyme	Chapel Hill
David Palmer Hudson	Monroe
Gloria Doubrava Jahnke	Chapel Hill
Frank James, Jr.	Greensboro
Karen Elizabeth MacFadden	Raleigh
Lisa Moeller	Sanford
Patricia Monahan	Raleigh
Linda Marion Moore	Asheville
Claire Frances Musick	Greensboro
Herbert Murray Parker, Jr.	Gates
Jo Anna Quinn	Gastonia
Vivian Harrell Ringer	Saratoga
Karen Patsy Robbins	Seagrove
Charles William Rogers, Jr.	Raleigh
Margaret Erskine Rogers	Spruce Pine
Robert Lawrence Schopler	Chapel Hill
Richard David Scott	Kenly
William Everett Smith	Fayetteville
†Mark Joseph Stehr	Raleigh
Carole Joyce Stemkowski	Carrboro
Patricia Ann Trepanier	Raleigh
John Gilbert VanSeiver	Willow Springs
Stephanie Lynn Wingo	Charlotte

Doctor of Education Degrees

Degrees Conferred August 8, 1985

Jonathan Whitney Bancroft, Adult and Community College
Education
Wakefield, Rhode Island

Dissertation: An Analysis of the Motivating Potential of 4-H Volunteer Jobs Compared to Satisfaction and Growth Need Expressed by New York 4-H Volunteers. (Under the direction of George L. Carter, Jr.)

Douglas Elliott Barrick, Adult and Community College
Education
Raleigh, North Carolina

Dissertation: The Effects of Hospice Volunteer Training on Death Anxiety Levels of Hospice Volunteer Candidates. (Under the direction of J. Conrad Glass, Jr.)

Lonnie Hardy Blizzard, Adult and Community College
Education
Kinston, North Carolina

Dissertation: The Importance of Lenoir Community College Goals as Perceived and Preferred by Selected Educational Leader Groups. (Under the direction of Ronald W. Shearon.)

Nicholas Caras, Adult and Community College Education
Fayetteville, North Carolina

Dissertation: A Factor Analysis of Physical Therapists' Reasons for Participating in Continuing Professional Education. (Under the direction of J. Conrad Glass, Jr.)

Martha Hinkle Fleer, Adult and Community College Edu-
cation
Winston-Salem, North Carolina

Dissertation: The Response of Private Higher Education to the Adult Learner in the Southern Association of Colleges and Schools Collegiate Institutions. (Under the direction of Edgar J. Boone.)

Wynton Harriet Hadley, Curriculum and Instruction
Fayetteville, North Carolina

Dissertation: Survey of Developmental Reading Programs in North Carolina State-supported Universities. (Under the direction of Barbara M. Parramore.)

Degrees Conferred December 17, 1985

David Austin Dillon, Industrial Arts Education
Winnfield, Louisiana

Dissertation: Factors That Effect a Person's Decision to Major in Industrial Arts/Technology. (Under the direction of Robert E. Wenig.)

- Ingelore Holthe, Adult and Community College Education
Fayetteville, North Carolina
- Dissertation: The Relationship between Self-concept, Significant Partner Support and Academic Achievement of Adult Female Students. (Under the direction of J. Conrad Glass, Jr.)
- Anselmo Bernad Mercado, Adult and Community College Education
Cagayan de Oro City, Philippines
- Dissertation: An Attempt at Collaborative Education by a Paraprofessional Working with Limited Resources Farm Families. (Under the direction of George L. Carter, Jr.)
- Janet Leonard Wester, Curriculum and Instruction
Louisburg, North Carolina
- Dissertation: Cognitive-Developmental Theories in English Composition: Program Description and Evaluation. (Under the direction of Ruie J. Pritchard and Barbara M. Parramore.)

Degrees Conferred May 10, 1986

- Roger Adrian Callanan, Guidance and Personnel Services
Grand Rapids, Michigan
- Dissertation: Moral Reasoning and Ego Development as Factors in Counseling. (Under the direction of Don C. Locke.)
- Roy Calvin Campbell, Adult and Community College Education
Greensboro, North Carolina
- Dissertation: The Use of Andragogical Concepts as Perceived by Certain Adult Educators. (Under the direction of J. Conrad Glass, Jr.)
- James Anderson Coats, Adult and Community College Education
Goldsboro, North Carolina
- Dissertation: The Impact of a Transition from a Two-year to a Four-year College on a Small, Private, Church-related, Liberal Arts Institution: A Case Study. (Under the direction of J. Conrad Glass, Jr.)
- George Richard Dixon, Adult and Community College Education
Morehead City, North Carolina
- Dissertation: A Study of the Characteristics, Motivations and Perceptions of Adult Part-time Students at North Carolina State University. (Under the direction of Edgar J. Boone and Estelle E. White.)
- Barbara Gail Miller Eichner, Adult and Community College Education
Anchorage, Alaska
- Dissertation: The Relationship of Family Strength to Self-esteem, Locus of Control, Type of Family and Spousal Support for Adult Women Participants in Extension-sponsored Leadership Training. (Under the direction of Edgar J. Boone.)

- Lois Ann Goering, Adult and Community College Education
Redwood Falls, Minnesota
- Dissertation: An Examination of Selected Factors Associated with Attitudes of Extension Professionals toward Women in Management in the Minnesota Agricultural Extension Service. (Under the direction of Edgar J. Boone.)
- Patty Maynard Hill, Adult and Community College Education
Chapel Hill, North Carolina
- Dissertation: The Impact of Nutrition Education through the Supplementary Food Program WIC in Effecting Change in Participant Knowledge, Attitude and Food Intake Patterns. (Under the direction of Ronald W. Shearon.)
- Patricia Ann Humphrey, Adult and Community College Education
Durham, North Carolina
- Dissertation: Staff Nurse Job Satisfaction as Related to Perceived Head Nurse Leader Behavior in Selected Veterans Administration Hospitals in the Southeastern United States. (Under the direction of Ronald W. Shearon.)
- Linda Baldwin Lindsey, Adult and Community College Education
Raleigh, North Carolina
- Dissertation: Learning Style Profiles of High School Graduates and Drop-outs Enrolled in North Carolina Community Colleges. (Under the direction of Joan W. Wright.)
- Sylvia Kay Thomas Pierce, Adult and Community College Education
Marshville, North Carolina
- Dissertation: A Comparative Analysis of Part-time Versus Full-time Community College Faculty Effectiveness. (Under the direction of Ronald W. Shearon.)
- William Joel Starling, Adult and Community College Education
Clinton, North Carolina
- Dissertation: The Association of Curriculum Expansion, Diversification and Selected Environmental Factors on Curriculum Enrollment in the North Carolina Community College System. (Under the direction of Ronald W. Shearon and Dale F. Campbell.)
- Jean Ethelene Walton, Occupational Education
Durham, North Carolina
- Dissertation: The Relationship between Psychological Type and Ability to Formulate Nursing Diagnoses. (Under the direction of Larry R. Jewell and Judith A. Davis.)

Doctor of Philosophy Degrees

Degrees Conferred August 8, 1985

- Barbara Louise Davis Abbott, Toxicology
Raleigh, North Carolina
Dissertation: Effects of Triethylamine upon Cellular Events in the Development of the Antenna of *Bracon hebetor*. (Under the direction of Daniel S. Grosch.)
- Kwasi Agyemang-Boateng, Nuclear Engineering
Kumasi, Ghana
Dissertation: The Use of Multiple Radiotracers Produced from Intrinsic Elements to Trace Float-Sink Components of Coal in the Flotation Process for Cleaning Coal. (Under the direction of Robin P. Gardner.)
- Stephen Harold Anderson, Soil Science
King Hill, Idaho
Dissertation: Spatial Variability of Soil Hydraulic Properties and Their Effects in Predicting Water Stress in Corn. (Under the direction of D. Keith Cassel.)
- Franklin Hall Arthur, Entomology
Jacksonville, Florida
Dissertation: Physiological Characteristics of Fraser Fir in Relation to Mortality Caused by the Balsam Woolly Adelgid. (Under the direction of Fred P. Hain.)
- Noparat Bamroongrugs, Crop Science
Pattani, Thailand
Dissertation: Interactive Effects of Photosynthetic Period and Light Intensity on Symbiotic Nitrogen Fixation and Some Morpho-physiological Responses of Peanut. (Under the direction of H. Douglass Gross.)
- Sylvio Brock, Fiber and Polymer Science
Rio de Janeiro, Brazil
Dissertation: Enhancement of Electrical Conductivity of Ion-implanted Polymer Films. (Under the direction of Solomon P. Hersh and Perry L. Grady.)
- Shih-Chen Chang, Civil Engineering
Chapel Hill, North Carolina
Dissertation: Temperature Effect on Reaeration Coefficient at Low Oxygenation Rate. (Under the direction of William S. Galler and Allen C. Chao.)
- Margaret Raab Dentine, Animal Science
Raleigh, North Carolina
Dissertation: Modeling of Rates of Genetic Progress and Investigation of Traits Associated with Longevity in Dairy Cattle. (Under the direction of Benjamin T. McDaniel.)

- Tsang-Tse Fang, Materials Engineering
Tainan, Taiwan, Republic of China
- Dissertation: Experimental Assessment of Statistical Theory of Sintering.
(Under the direction of Hayne Palmour III.)
- Abdulgader Abdalla Fathaddin, Psychology
Mecca, Saudi Arabia
- Dissertation: Risk Perceptions and Decision Making in the Management
of Technological Innovations: The Case of Water Reuse.
(Under the direction of Frank J. Smith.)
- Dwight Starnes Fisher, Crop Science
Charlotte, North Carolina
- Dissertation: Grass Canopy Dry Matter Distribution and Animal Diet
Relationships. (Under the direction of Joseph C. Burns.)
- Christine Julia Hager, Economics
Raleigh, North Carolina
- Dissertation: Demand for Nutrient and Nonnutrient Components in
Household Purchases of Red Meat, Poultry and Fish Pro-
ducts Using a Hedonic Approach. (Under the direction of
Raymond B. Palmquist.)
- Ali Ghalib Mohammed Hussain, Wood and Paper Science
Baghdad, Iraq
- Dissertation: The Use of Waste from Old Corrugated Containers for the
Manufacture of Multi-wall Cement Sack Paper. (Under the
direction of Robert G. Hitchings and Heinz G. Olf.)
- George Pryor Johnson III, Botany
Raleigh, North Carolina
- Dissertation: Revision of *Castanea* Section *Balanocastanon* (Fagaceae).
(Under the direction of James W. Hardin.)
- Ann Catherine Kennedy, Soil Science
Raleigh, North Carolina
- Dissertation: The Effect of High Temperature Stress on *Bradyrhizobium*
japonicum. (Under the direction of Arthur G. Wollum II.)
- Jung Hyoun Kim, Electrical and Computer Engineering
Kyung Ki-Do, Korea
- Dissertation: A Multiprocessor Architecture for Two-dimensional Digital
Filters. (Under the direction of Winsor E. Alexander.)
- Avraham Lacser, Marine, Earth and Atmospheric Sciences
Petach Tikva, Israel
- Dissertation: A Model for the Evolving Stably Stratified Nocturnal Boun-
dary Layer Based on the Turbulent Kinetic Energy Equa-
tion. (Under the direction of S. Pal S. Arya.)
- Diane Dee Lauritsen, Zoology
Kennard, Nebraska
- Dissertation: Filter-feeding, Food Utilization and Nutrient Reminerali-
zation by *Corbicula fluminea* (Vivalvia) and Its Contribution
to Nutrient Cycling in a North Carolina River. (Under the
direction of Samuel C. Mozley.)

- Christine Elyse Heinecke Lehmann, Mathematics Education
Valparaiso, Indiana
- Dissertation: Patterns of Adult Mathematics Learners' Causal Attributions of Success and Failure at Mathematical Tasks. (Under the direction of John R. Kolb and William M. Waters, Jr.)
- John Joseph Lepri, Zoology
Flint, Michigan
- Dissertation: Investigations on the Reproductive Ecology of the Pine Vole *Microtus pinetorum*. (Under the direction of John G. Vandenbergh.)
- Carl Joseph Long II, Chemistry
Carrollton, Kentucky
- Dissertation: The Synthesis of Derivatives of 1,3-Dithiepin Containing the Tetrathioethylene Unit and a Brief Exploration of Their Coordination Chemistry. (Under the direction of Robert D. Bereman.)
- Robert James Moorhead, Electrical Engineering
Grenada, Mississippi
- Dissertation: Image Sequence Compression Using a Motion-compensated Technique. (Under the direction of Sarah A. Rajala.)
- Ann Lackner O'Leary, Plant Pathology
Pittsburgh, Pennsylvania
- Dissertation: Effects of Postinfection Applications of Ergosterol Biosynthesis-inhibiting Fungicides on Lesion Formation and Pseudothecial Development of *Venturia inaequalis* and Influence of Temperature and Moisture of the Quantitative Production of Pseudothecia. (Under the direction of Turner B. Sutton and Larry F. Grand.)
- Daniel Joseph O'Leary, Plant Pathology
Savannah, Georgia
- Dissertation: Effects of Fungicide and Host Resistance on Epidemics of Tomato Early Blight. (Under the direction of Paul B. Shoemaker and Eddie Echandi.)
- Mickey Elton Parish, Food Science
Davenport, Florida
- Dissertation: Yeast Flora of Muscadine (*Vitis rotundifolia*) Grapes and Effects of Antimicrobial Agents on Selected Wine Yeasts. (Under the direction of Daniel E. Carroll.)
- Ronald Alan Rudder, Physics
Nathalie, Virginia
- Dissertation: Amorphous Hydrogenated Silicon Germanium Alloy Thin Films. (Under the direction of Gerald Lucovsky.)
- Farshid Sadeghi, Mechanical Engineering
Tehran, Iran
- Dissertation: Analysis of Thermal Elastohydrodynamic Lubrication in Rolling/Sliding Contacts. (Under the direction of Thomas A. Dow.)

- Abd El-Fattah Mohamed Seyam, Fiber and Polymer Science
Alexandria, Egypt
- Dissertation: On the Mechanics of Woven Fabrics. (Under the direction of Aly H. M. El-Shiekh.)
- Ping Peter Shang, Fiber and Polymer Science
Tainan, Taiwan, Republic of China
- Dissertation: Characterization of Anisotropy of Spunbonded Fiberwebs (Nonwovens). (Under the direction of Subhash K. Batra.)
- Theodore Henry Shear, Forestry
New Orleans, Louisiana
- Dissertation: Seed Properties of Loblolly Pine (*Pinus taeda* L.): Genetic Variability and Effects of Seedling Establishment and Performance. (Under the direction of Thomas O. Perry.)
- Jarbas Yukio Shimizu, Forestry
Curitiba-Parana, Brazil
- Dissertation: Inter-family Competition in Loblolly Pine and Its Effects in Genetic Tests. (Under the direction of Bruce J. Zobel.)
- John Martin Shribbs, Horticultural Science
Santa Monica, California
- Dissertation: Influence of Twelve Ground Cover Systems on the Growth and Nutrition of Golden Delicious Apple Trees. (Under the direction of Walter A. Skroch and Thomas J. Monaco.)
- James Stephen Staton, Chemical Engineering
Charlotte, North Carolina
- Dissertation: Performance and Modeling of a Hot Potassium Carbonate Acid Gas Removal System in Treating Coal Gas. (Under the direction of Ronald W. Rousseau.)
- Anne-Marie Stomp, Botany
Wendell, North Carolina
- Dissertation: Approaches to Regeneration in Mature Pine Tissue: Shoot Production from Needle Fascicles and Effect of Light on Callus Growth and Organization. (Under the direction of Ralph L. Mott and Henry V. Amerson.)
- Karen Marie Templeton-Somers, Horticultural Science
Cary, North Carolina
- Dissertation: Variation in Tissue Cultures of Sweet Potato. (Under the direction of Wanda W. Collins and Ralph L. Mott.)
- William Lee Truman, Mathematics Education
Morven, North Carolina
- Dissertation: The Construction of a Multi-factor Test for Teaching Strategies Research in Mathematics. (Under the direction of John R. Kolb.)
- Yuan-Chung Tsai, Wood and Paper Science
Taipei, Taiwan, Republic of China
- Dissertation: The Soda-AQ/Oxygen Process as an Alternative to the Kraft Process for Production of Bleached Pulp from Loblolly Pine. (Under the direction of Hou-min Chang and Josef S. Gratzl.)

- Leon Tzou, Civil Engineering
Taipei, Taiwan, Republic of China
Dissertation: Ames Test as Carcinogenic/Mutagenic Water Quality Index in Drinking Water. (Under the direction of Charles Smallwood, Jr. and Allen C. Chao.)
- Charles Timothy Vance, Chemistry
Chesapeake, Virginia
Dissertation: Syntheses and Coordination Chemistry of New Organosulfur Ligands Containing the Tetrathioethylene Unit. (Under the direction of Robert D. Bereman.)
- Susan Elizabeth Webb, Sociology
Myrtle Beach, South Carolina
Dissertation: Residential Mobility in the Retirement Years: Evidence from the Social Security Administration's Longitudinal Retirement History Study, 1969-1975. (Under the direction of Elizabeth M. Suval.)
- David Steven Wells, Toxicology
Oneonta, New York
Dissertation: Studies on the Metabolism of Propetamphos. (Under the direction of Walter C. Dauterman.)
- Kathy Ann Zarilla, Microbiology
New Castle, Pennsylvania
Dissertation: Isolation and Characterization of Hydrocarbon-utilizing, Obligately Thermophilic Bacteria. (Under the direction of Jerome J. Perry.)
- Qing Hua Zhang, Marine, Earth and Atmospheric Sciences
Qingdao, People's Republic of China
Dissertation: The Interaction between Estuarine Plumes and Continental Shelf Waters. (Under the direction of Leonard J. Pietrafesa and Gerald S. Janowitz.)

Degrees Conferred December 17, 1985

- Robert William Allison, Wood and Paper Science
Rotorua, New Zealand
Dissertation: Oxidative Pretreatment with Hydrogen Peroxide Prior to Alkaline Pulping. (Under the direction of Josef S. Gratzl.)
- Farid Mohammad Askari, Marine, Earth and Atmospheric Sciences
Tehran, Iran
Dissertation: Diagnostic Model for Steady Circulation on Onslow Bay, North Carolina. (Under the direction of Leonard J. Pietrafesa.)
- Alan Rogers Ayers, Plant Pathology
Bear Grass, North Carolina
Dissertation: Factors Affecting the Ecology and Damage Potential of *Cricodemella ornata* and *Cricodemella sphaerocephala* on Peanuts and Corn. (Under the direction of Kenneth R. Barker and Harry E. Duncan.)

- Cynthia Lynne Bailey, Chemistry
Fayetteville, North Carolina
Dissertation: Preparation, Characterization and Reactivity of a Series of Tetraazaannulene Complexes as Small Molecule Mimics for Metalloenzymes. (Under the direction of Robert D. Bereman.)
- Jerry J. Baron, Horticultural Science
Lyndhurst, Ohio
Dissertation: The Mechanism of Tolerance of Blueberry (*Vaccinium* sp) to Hexazinone. (Under the direction of Thomas J. Monaco.)
- Alan Dale Batchelor, Materials Engineering
Johnsonville, South Carolina
Dissertation: An Experimental Approach to the Sintering Methodology for a Complex Ceramic System. (Under the direction of Hayne Palmour III.)
- Thomas E. Bregger, Crop Science
Redlands, California
Dissertation: Analysis, Extraction and Degradation of CGA-41065 in Soil. (Under the direction of Jerome B. Weber.)
- Robert Fitzgerald Brooker, Economics
Los Angeles, California
Dissertation: Multiple Component Pricing and the Composition of Milk: An Econometric Model. (Under the direction of Richard K. Perrin.)
- John Boringo Byalebeka, Crop Science
Bwera, Uganda
Dissertation: Effect of the Host Genotype of *Bradyrhizobium* Acceptance and Performance on Peanuts (*Arachis hypogaea* L.). (Under the direction of Gerald H. Elkan and Johnny C. Wynne.)
- Connie Ray Campbell, Crop Science
Raleigh, North Carolina
Dissertation: Chemical Content and Usability of Close-grown Tobacco. (Under the direction of James F. Chaplin.)
- John Ankong Cha, Chemical Engineering
Hong Kong
Dissertation: The Aerobic Coupling of Alkaline Phenols and Thiols Catalyzed by Cuprous Chloride: Kinetic Results and Engineering Significance. (Under the direction of Phooi K. Lim.)
- Peng-Kuen Chiang, Electrical Engineering
Taipei, Taiwan, Republic of China
Dissertation: Organometallic Chemical Vapor Deposition Growth of Sb Compounds ($\text{GaAs}_{1-x}\text{Sb}_x$, InSb and $\text{InAs}_{1-x}\text{Sb}_x$). (Under the direction of John R. Hauser and Salah M. Bedair.)
- Timothy Gladstone Clapp, Mechanical Engineering
Siler City, North Carolina
Dissertation: Approximation and Analysis of Tire/Pavement Contact Information Resulting from Road Surface Roughness. (Under the direction of Allen C. Eberhardt.)

- Ted Roy Clem, Biomathematics
Panama City, Florida
- Dissertation: On the Statistical-Mechanical Representation of a Quasi-static Process. (Under the direction of Don L. Ridgeway.)
- Stephen Phillip Cook, Entomology
Fairfield, Ohio
- Dissertation: Comparing Loblolly and Shortleaf Pine as Hosts of the Southern Pine Beetle *Dendroctonus frontalis* Zimmermann (Coleoptera: Scolytidae.) (Under the direction of Fred P. Hain.)
- James R. Cooper, Soil Science
Bedford, Virginia
- Dissertation: Phosphorus and Sediment Redistribution from Cultivated Fields into Riparian Areas. (Under the direction of J. Wendell Gilliam.)
- Renato Machado Cotta, Mechanical Engineering
Rio de Janeiro, Brazil
- Dissertation: Steady, Transient and Periodic Thermal Entry Solutions of Forced Convection in Channel Flow. (Under the direction of M. Necati Ozisik.)
- John Lewis Crouse, Fiber and Polymer Science
Winston-Salem, North Carolina
- Dissertation: Structure and Properties of Polyethylene Filaments Containing n-Octadecane. (Under the direction of John A. Cuculo.)
- Robert James Donohoe, Chemistry
Phoenix, Arizona
- Dissertation: An Electric Absorption and Resonance Raman Study of Some Tris(diimine) Complexes of d⁶ Metals and Their Reduction Products. (Under the direction of Dennis W. Wertz and M. Keith DeArmond.)
- Edward Francis Durner, Horticultural Science
Annapolis, Maryland
- Dissertation: Flowering Physiology in *Fragaria* x *ananassa* Duch. (Under the direction of Frank L. Haynes and E. Barclay Poling.)
- Stephen Andrew Ebelhar, Soil Science
Owensboro, Kentucky
- Dissertation: Nitrogen and Potassium Effects of Growth, Photosynthate Production and Nutrient Relationships for Corn (*Zea mays* L.) Genotypes Differing in Average Ear Number. (Under the direction of Eugene J. Kamprath.)
- Michael Lee Fearheiley, Chemistry
Decatur, Illinois
- Dissertation: Growth and Characterization of CuInSe₂ Crystals and Their Utilization for Photovoltaic Solar Energy Conversion. (Under the direction of Klaus J. Bachmann.)

Jeffrey John Fuhrmann, Soil Science
Oceanside, California

- Dissertation: The *Glycine max* - *Bradyrhizobium japonicum* Symbiosis as Affected by Associated Rhizosphere Bacteria. (Under the direction of Arthur G. Wollum II.)

Cynthia Carol Green, Crop Science
Wynne, Arkansas

- Dissertation: The Evaluation and Inheritance of the Components of Partial Resistance to Early Leafspot (*Cercospora arachidicola* Hori) in Peanut. (Under the direction of Johnny C. Wynne.)

Josephine Patterson Guglielmi, Mathematics
Tarboro, North Carolina

- Dissertation: Compactifications with Singular Remainders. (Under the direction of Richard E. Chandler and Gary D. Faulkner.)

Janet Ackermann Hall, Zoology
Durham, North Carolina

- Dissertation: Spinal Motoneuron Cell Death and Developmental Changes in Contractile Protein Expression. (Under the direction of John F. Roberts.)

Orlando Elwood Hankins, Nuclear Engineering
Hubert, North Carolina

- Dissertation: An Experimental Investigation of the Properties of the Hot Electron Rings in the ELMO Bumpy Torus Device Using Hard X-ray Diagnostic Techniques. (Under the direction of Raymond F. Saxe and Donald L. Hillis.)

Mohammad Animul Haque, Plant Pathology
Patuakhali, Bangladesh

- Dissertation: Characteristics of North Carolina Strains of *Pseudomonas solanacearum* from Flue-cured Tobacco. (Under the direction of Eddie Echandi.)

Brode Horest Harrell, Jr., Crop Science
Jackson, North Carolina

- Dissertation: The Persistence of Low Levels of Picloram and the Effects of Flue-cured Tobacco in Some North Carolina Soils. (Under the direction of Thomas J. Sheets.)

Glendora Bateman Heavner, Psychology
Smithfield, North Carolina

- Dissertation: Some Effects of Graduated Decrease and Discontinuation of Neuroleptics in Severely and Profoundly Mentally Retarded Institutionalized Adults. (Under the direction of Rachel F. Rawls and Lois A. Makoid.)

Gregory Helton Hobson, Nuclear Engineering
Oakton, Virginia

- Dissertation: Automatic Determination of Pressurized Water Reactor Core Loading Patterns Which Maximize End-of-cycle Reactivity within Power Peaking and Burnup Constraints. (Under the direction of Paul J. Turinsky.)

- Carl Corley Holbrook, Crop Science
Jacksonville, Florida
- Dissertation: Approaches to Breeding for High Yield and High Percent Seed Protein in Soybeans (*Glycine max* L. Merrill). (Under the direction of Jack W. Burton and Earl A. Wernsman.)
- Young Keun Hong, Fiber and Polymer Science
Seoul, Korea
- Dissertation: Mixture of Rod-like and Flexible Polymers. (Under the direction of Richard D. Gilbert and Raymond E. Fornes.)
- Darrell Erik Paul Hoy, Mechanical Engineering
Fayetteville, North Carolina
- Dissertation: The Shock Compaction of Titanium-Aluminum Elemental Powder Mixtures and Accompanying Alloy Formation. (Under the direction of John K. Whitfield.)
- Cathy McCabe Hoyle, Nutrition
Bishopville, Maryland
- Dissertation: The Effects of Photostimulation, Fat Supplementation and Dietary Energy Restriction on Initial Egg Weight of SCWL Pullets and the Effects of Varying Protein and Energy Levels on Induced Molted Hen Performance. (Under the direction of Jimmy D. Garlich.)
- James Robert Huddle, Physics
Tokyo, Japan
- Dissertation: Acceleration of Multiply-charged Ions from Fast Ion Atomic Physics Experiments. (Under the direction of J. Richard Mowat.)
- Roy Houston Johnson, Jr., Fiber and Polymer Science
Cary, North Carolina
- Dissertation: Stretch and Recovery Performance of Textured Polyester Woven Fabrics. (Under the direction of Mansour H. Mohamed and Peter R. Lord.)
- Norbert Edward Kaminski, Physiology and Toxicology
Morton Grove, Illinois
- Dissertation: Studies Investigating the Active and Passive Targeting of Xenobiotics at Rat Peritoneal Macrophages. (Under the direction of John F. Roberts and Frank E. Guthrie.)
- Nasser Hussein Karam, Material Engineering
Cairo, Egypt
- Dissertation: Kinetics and Mechanisms of Low Temperature Deformation in High Purity Niobium Single Crystals. (Under the direction of Hans Conrad.)
- Grant Bumgarner Kenion, Chemistry
Charlotte, North Carolina
- Dissertation: Solvent Carbene Interactions and Nucleophilic Carbenes. (Under the direction of Suzanne T. Purrington.)
- Hyeong Joon Kim, Materials Engineering
Seoul, Korea
- Dissertation: Epitaxial Growth, Doping and Characterization of Monocrystalline Beta Silicon Carbide Thin Films and Fabrication of Electronic Devices. (Under the direction of Robert F. Davis.)

- James Arthur Kolmer, Plant Pathology
Ames, Iowa
Dissertation: Genetics of Virulence and Fertility in the Fungus *Cochliobolus heterostrophus*. (Under the direction of Kurt J. Leonard.)
- George Walter Koszalka, Biochemistry
Springfield, Virginia
Dissertation: Transient Covalent Affinity Purification of Sulphydryl Oxidase and the Enzyme's Interaction with Horseradish Peroxidase. (Under the direction of Harold E. Swaisgood.)
- Steven Alan Kuehl, Marine, Earth and Atmospheric Sciences
Locust, New Jersey
Dissertation: Sediment Accumulation and the Formation of Sedimentary Structures on the Amazon Continental Shelf. (Under the direction of Charles A. Nittrouer and David J. DeMaster.)
- Jae-Ok Lee, Economics
Seoul, Korea
Dissertation: Japanese Agricultural Policies and Import Demand for Wheat. (Under the direction of Paul R. Johnson.)
- Rex Allan Liebl, Crop Science
Milwaukee, Wisconsin
Dissertation: Effects of Chlorsulfuron on Diclofop-Methyl Toxicity to Italian Ryegrass (*Lolium multiflorum*) and Italian Ryegrass Interference in Wheat (*Triticum aestivum*). (Under the direction of A. Douglas Worsham.)
- I-Chen Lin, Civil Engineering
Taipei, Taiwan, Republic of China
Dissertation: An Investigation of Tsunami Hazard. (Under the direction of Chi C. Tung.)
- Cheng-Kung Liu, Fiber and Polymer Science
Toayan, Taiwan, Republic of China
Dissertation: Fiber Spinning Studies for the Cellulose/Ammonia/Ammonium Thiocyanate System. (Under the direction of John A. Cuculo.)
- Sergio Roberto Lopez-Permouth, Mathematics
Guatemala City, Guatemala
Dissertation: Rings of Quotients. (Under the direction of Jiang Luh.)
- Timothy James Lysyk, Entomology
Saint Albert, Alberta, Canada
Dissertation: Sampling and Dispersal of House Fly (*Musca domestica* L.) (Diptera: Muscidae) Populations in Poultry Houses. (Under the direction of Richard C. Axtell.)
- Jacquelyn Williams McClelland, Nutrition
Cary, North Carolina
Dissertation: The Effects of Dietary Soy Protein on Cholesterol-induced Atherosclerosis in Japanese Quail. (Under the direction of Jason C. H. Shih.)

- Mary Eugenia Lopez Menetrez, Botany
Durham, North Carolina
Dissertation: Pre-germination and Germination Changes in Storage Components and Alpha Galactosidase Activity in *Striga asiatica* Seeds. (Under the direction of Roger C. Fites.)
- William Marshall Moses, Jr., Mechanical Engineering
Lexington, South Carolina
Dissertation: An Experimental Investigation of the Heat Transfer across Periodically Contacting Surfaces. (Under the direction of Richard R. Johnson.)
- Christopher Charles Mundt, Plant Pathology
Port Jervis, New York
Dissertation: Field and Computer Simulation Studies of the Effects of Host Genotype Unit Area on the Increase and Spread of Foliar Disease in Mixtures of Resistant and Susceptible Plants. (Under the direction of Kurt J. Leonard.)
- George Lee Murphy, Microbiology
Houston, Texas
Dissertation: The Effects of Chlorinated Alkanes on Lipids of Hydrocarbon-utilizing Bacteria and Fungi. (Under the direction of Jerome J. Perry.)
- Armando Notz, Entomology
Maracay, Venezuela
Dissertation: Application of *Heliothis virescens* (F.) (Lepidoptera: Noctuidae) Establishment, Survival and Feeding Damage to an Economic Threshold on Flue-cured Tobacco in North Carolina. (Under the direction of Julius R. Bradley, Jr.)
- Robert Allen Olmsted, Microbiology
Waverly, New York
Dissertation: Characterization of Pathogenic Mutants of Sindbis Virus: Identification of Selectable Phenotypic Markers for the Attenuation of Virulence. (Under the direction of Robert E. Johnston.)
- Mark Otieno Owango, Animal Science
Naivasha, Kenya
Dissertation: The Interrelationships of Methionine, Cystine, Choline and Inorganic Sulfate in Broiler Rations. (Under the direction of William E. Donaldson and John F. Ort.)
- Jae Won Park, Food Science
Pusan, Korea
Dissertation: Effects of Cryoprotectants on Properties of Beef Proteins during Frozen Storage. (Under the direction of Donald D. Hamann.)
- Jong-Kwan Park, Civil Engineering
Seoul, Korea
Dissertation: Die Compaction of Powder: Constitutive Modelling and Finite Element Calculation. (Under the direction of Yasuyuki Horie.)

- Michael Joseph Pearce, Chemistry
Alamosa, Colorado
- Dissertation: Development and Use of Electronic Aerosol Modulation in Premix Flame Atomic Spectrometry. (Under the direction of Charles B. Boss.)
- Robert Russell Rhinehart, Jr., Chemical Engineering
Raleigh, North Carolina
- Dissertation: Dynamic Modeling and Control of a Pressurized Fluidized Bed Coal Gasification Reactor. (Under the direction of Richard M. Felder.)
- Craig Jon Schroeder, Microbiology
Carroll, Iowa
- Dissertation: The Cloning and DNA Sequence Analysis of the Wild-type and Mutant Cyclic AMP Receptor Protein Genes from *Salmonella typhimurium*. (Under the direction of Walter J. Dobrogosz.)
- David Lawrence Sen, Statistics
Alexandria, Virginia
- Dissertation: Robustness of Single Unit Root Test Statistics in the Presence of Multiple Unit Roots. (Under the direction of David A. Dickey.)
- Kab Sik Seo, Fiber and Polymer Science
Seoul, Korea
- Dissertation: Electron Spin Resonance Investigations and Surface Characterization of TGDDM-DDS Epoxy and T-300 Graphite Fiber Exposed to Ionizing Radiation. (Under the direction of Raymond E. Fornes and Richard D. Gilbert.)
- Souad Nouralla Shehata, Industrial Engineering
Raleigh, North Carolina
- Dissertation: Development of Theoretical Foundation for Organizational Productivity Analysis and Measurement. (Under the direction of William A. Smith, Jr.)
- Barbara Panda Symser, Toxicology
West Springfield, Massachusetts
- Dissertation: Metabolism of Pesticides and Related Compounds by Purified Microsomal Monooxygenases. (Under the direction of Ernest Hodgson.)
- Patricia McKeone Snyder, Operations Research
Fayetteville, North Carolina
- Dissertation: Incorporating Non Product Form Stations into Otherwise Product Form Closed Queueing Networks. (Under the direction of William J. Stewart.)
- Michael David Stuart, Zoology
West Monroe, Louisiana
- Dissertation: Helminth Parasites of the Eastern Box Turtle, *Terrapene c. carolina*, from North Carolina. (Under the direction of Grover C. Miller.)

Suzanne Elizabeth Szabo, Sociology
Greenville, North Carolina

Dissertation: A Synthesis of the Columbia and Michigan Models of Candidate Choice. (Under the direction of Ronald C. Wimberley.)

Gary Wayne Wallace, Food Science
Lorena, Texas

Dissertation: A Mechanistic Study of Unique Porous Glass Bead Derivatives Utilized for the Reversible Covalent Immobilization of Nucleophilic Compounds and the Production of 'Native-like' Reoxidized, Refolded Chymotrypsinogen A. (Under the direction of Harold E. Swaisgood.)

Frank Robert Walls, Jr., Crop Science
Goldsboro, North Carolina

Dissertation: The Potential of Imazaquin for Weed Control in Flue-cured Tobacco (*Nicotiana tabacum*). (Under the direction of William K. Collins.)

Jin-Der Wang, Electrical Engineering
Chia-Yi, Taiwan, Republic of China

Dissertation: Analysis of Adaptive Filter Algorithms with an Application to Harmonic Noise Cancellation in Distribution Power Line Communications. (Under the direction of H. Joel Trussell.)

Degrees Conferred May 10, 1986

Mary Beth Adams, Forestry and Soil Science
Seymour, Indiana

Dissertation: Starch and Nutrient Concentrations in Roots and Foliage of Loblolly Pine (*Pinus taeda* L.). (Under the direction of H. Lee Allen and Charles B. Davey.)

Sami Amin Al-Arian, Electrical Engineering
Jerusalem, Palestine

Dissertation: Modeling, Testing and Fault Masking in CMOS Networks. (Under the direction of Dharma P. Agrawal.)

Gregory Stanley Allgood, Toxicology
Cary, North Carolina

Dissertation: Oxygen Toxicity in Thermophilic Bacteria. (Under the direction of Jerome J. Perry.)

Pamela Banks-Lee, Fiber and Polymer Science
Greensboro, North Carolina

Dissertation: Optimization of Textile Spindle Designed by Use of Finite Element Analysis. (Under the direction of Paul A. Tucker, Jr. and Paul D. Emerson.)

Jeffrey Wayne Barton, Microbiology
Shreveport, Louisiana

Dissertation: Genetic Analysis of the 3'-Flanking Sequence of the *crp* Gene of *Escherichia coli* That Induces cAMP Suppressor Functions. (Under the direction of Thoyd Melton.)

- Teresa Lynn Blalock, Nutrition
Roxboro, North Carolina
Dissertation: Studies on the Role of Iron in the Reversal of Zinc, Cadmium, Vanadium, Nickel and Cobalt Toxicities in Broiler Pullets. (Under the direction of Charles H. Hill.)
- Jeffrey Allen Boyd, Toxicology
Durham, North Carolina
Dissertation: The Oxidation of Aromatic Amine Carcinogens by Prostaglandin H Synthase. (Under the direction of Ernest Hodgson.)
- Norma Jean Bond Burgess, Sociology
Stanton, Tennessee
Dissertation: Race, Wives' Employment and Social-Psychological Well-being: Patterns of Black-White Differences among U. S. Women. (Under the direction of Odell Uzzell and Frank M. Howell.)
- Paul John Caldwell, Electrical Engineering
Raleigh, North Carolina
Dissertation: Design and Fabrication of Quantum-well and Impurity-disordered-superlattice Coupled-cavity Lasers. (Under the direction of Robert M. Kolbas.)
- David Jerome Carty, Soil Science
Homestead, Florida
Dissertation: Aluminum-substituted Goethites: Synthesis, Properties and Enrichment. (Under the direction of Sterling B. Weed.)
- Subhash Chandra, Wood and Paper Science
Budaun, India
Dissertation: Studies on Ozonization of Softwood Pulps and Evaluation of Oxygen Prebleaching Options. (Under the direction of Josef S. Gratzl.)
- William John Chimiak, Electrical Engineering
Cary, North Carolina
Dissertation: Performance Evaluation of the National Bureau of Standards Implementation of the Open System Interconnection Class 4 Transport Protocol in a Wide Area Network Environment. (Under the direction of Wushow Chou and Arne A. Nilsson.)
- Kenneth Dean Clark, Applied Mathematics
Durham, North Carolina
Dissertation: The Numerical Solution of Linear Time Varying Singular Systems of Differential Equations by Difference Methods. (Under the direction of Stephen L. Campbell.)
- Eric Atlas Davidson, Forestry
Durham, North Carolina
Dissertation: Gaseous Nitrogen Losses from Two Forested Watersheds via Nitrification and Denitrification. (Under the direction of Thomas O. Perry.)

- Earl Lackey Dean, Jr., Economics
Raleigh, North Carolina
- Dissertation: Competitiveness of Alternative Forest Products Manufacturing Facilities in Purchasing Timber Inputs. (Under the direction of Richard A. King.)
- Kenneth Grant Dodds, Statistics
Gore, New Zealand
- Dissertation: Resampling Methods in Genetics and the Effects of Family Structure in Genetic Data. (Under the direction of Bruce S. Weir.)
- Fabiano Ribeiro do Vale, Soil Science
Lavras, M. G., Brazil
- Dissertation: Ammonium-Potassium Interactions during Influx into Corn (*Zea mays* L.) Root Systems as Affected by Nitrogen and Potassium Status of the Roots. (Under the direction of William A. Jackson.)
- Mohamed Abdelgawad El-Oshar, Entomology
Benghazi, Libya
- Dissertation: Studies on the Metabolism of Vamidothion and Its Thio Analog in Mammals and Insects. (Under the direction of Walter C. Dauterman.)
- Phillip Roberts Esbenshade, Plant Pathology
Lancaster, Pennsylvania
- Dissertation: Biochemical Taxonomy and Phylogeny of Selected *Meloidogyne* Species. (Under the direction of Anastasios C. Triantaphyllou.)
- Richard Brian Flagler, Crop Science
Tustin, California
- Dissertation: Effects of Ozone and Water Deficit of Growth, Yield and Nitrogen Metabolism of Soybeans. (Under the direction of Allen S. Heagle and Robert P. Patterson.)
- Ronald David Franklin, Psychology
Candor, North Carolina
- Dissertation: Models of Artificial Intelligence in Psychological Reporting: An Empirical Investigation of Two Expert Systems. (Under the direction of N. William Walker.)
- Steven Wylie George, Plant Pathology
Harrah, Oklahoma
- Dissertation: The Inoculation and Evaluation of Strawberry Plants with *Phytophthora fragariae* and Its Isolation and Growth in vitro. (Under the direction of Robert D. Milholland.)
- Mwenja P. Gichuru, Soil Science
Ibadan, Kenya
- Dissertation: The Management of Phosphorus, Calcium and Magnesium in Low-input Cropping Systems in the Humid Tropics. (Under the direction of Pedro A. Sanchez.)

- Jeffrey Lynn Gunsolus, Crop Science
Stoughton, Wisconsin
- Dissertation: Reciprocal Interference Effects between Weeds and Soybeans (*Glycine max*) Measured by Area of Influence Methodology. (Under the direction of Harold D. Coble.)
- Carol Ann Gwynn, Psychology
Caledonia, New York
- Dissertation: Effects of a Group Intervention for Children of Divorce. (Under the direction of Patricia F. Horan.)
- Theresa Edwards Hayes, Psychology
Raleigh, North Carolina
- Dissertation: The Effect of Intervention Programs on the Metacognitive Characteristics, Program Identification and Academic Performance of Black College Freshmen. (Under the direction of Rachel F. Rawls, Lois A. Makoid and William P. Erchul.)
- William Thomas Heartz, Civil Engineering
Richland, Washington
- Dissertation: Properties of a Piedmont Residual Soil. (Under the direction of Philip C. Lambe and Harvey E. Wahls.)
- Maxine Thomas Highsmith, Botany
Raleigh, North Carolina
- Dissertation: Starch Mobilization in Mature Leaves of Soybean *Glycine max* (L.) Merrill in Relation in Growth of the Developing Leaves. (Under the direction of A. Russell Main and G. Ray Noggle.)
- Jeffrey Maynard Hinshaw, Zoology
Raleigh, North Carolina
- Dissertation: Factors Affecting Feeding, Survival and Growth of Larval and Early Juvenile Yellow Perch (*Perca flavescens* Mitchill). (Under the direction of Melvin T. Huish.)
- Selwyn Lamar Hollis, Applied Mathematics
Rutledge, Georgia
- Dissertation: Globally Bounded Solutions of Reaction-Diffusion Systems. (Under the direction of Robert H. Martin, Jr.)
- Matthew Buckingham Hoyt, Fiber and Polymer Science
Raleigh, North Carolina
- Dissertation: The Energy of Interaction for the Epitaxial Relationship of Polyethylene Oxide-Nylon 66. (Under the direction of Raymond E. Fornes.)
- Shian-Shyong Hsiao, Physics
Taipei, Taiwan, Republic of China
- Dissertation: Hypernuclear Formation through Kaon Electromagnetic Production. (Under the direction of Stephen R. Cotanch.)
- Bengt Trued Hyberg III, Economics and Forestry
Burlington, New Jersey
- Dissertation: The Development and Empirical Testing of a Utility Maximization Model for NIPF Landowner Forest Management. (Under the direction of Duncan M. Holthausen, Jr., D. Lester Holley, Jr. and Joseph E. de Steiguer.)

- Kuan-Jen Jeng, Mechanical Engineering
Taipei, Taiwan, Republic of China
Dissertation: Evaporation and Ignition Delay of Fuel and Emulsion Droplets. (Under the direction of Elsayed M. Afify.)
- Youn Ho Jung, Nuclear Engineering
Taejon, Choong Nam, Korea
Dissertation: Effect of Dynamic Strain Aging on Fracture Characteristics of A533B-CL1 Nuclear Pressure Vessel Steel. (Under the direction of K. Linga Murty.)
- Kamnoon Kamchanapoom, Botany
Bangkok, Thailand
Dissertation: Fluorescence, Video and Electron Microscopic Studies of Fusion of Fusogenic Carrot Protoplasts. (Under the direction of Wendy F. Boss and Roger C. Fites.)
- Malee Kamchanapoom, Botany
Bangkok, Thailand
Dissertation: Nuclear DNA and Ultrastructural Changes in the Apical Meristem of Tobacco during the Transition from Vegetative to Reproductive Development. (Under the direction of Judith F. Thomas.)
- Jerrold Williams Kannel, Mechanical Engineering
Columbus, Ohio
Dissertation: Development of an Analytical Model for Traction between Cylinders. (Under the direction of Thomas A. Dow.)
- Paul Henry Knowles, Mathematics
Baltimore, Maryland
Dissertation: Symbolic Integration in Terms of Error-Functions and Logarithmic Integrals. (Under the direction of Michael F. Singer.)
- Mann Ping Ko, Plant Pathology
Allston, Massachusetts
Dissertation: Responses of Soybean Nodulation to Root-infection by *Heterodera glycines*. (Under the direction of Kenneth R. Barker and Jeng-Sheng Huang.)
- Dorothy Mae Latta, Toxicology
Durham, North Carolina
Dissertation: Effects of Dietary Sulfur Amino Acids on Lead Toxicity in Chicks. (Under the direction of William E. Donaldson.)
- Young Moo Lee, Fiber and Polymer Science
Seoul, Korea
Dissertation: Analysis of Thermal Protective Performance of Heat Resistance Polymeric Fabrics. (Under the direction of Roger L. Barker.)
- James Dunwoody Leiby, Economics
West Chester, Pennsylvania
Dissertation: An Analysis of Farm Size and Growth: The Case of Southern Dairy Farms. (Under the direction of Daniel A. Sumner and Richard K. Perrin.)

- Shu-Ya Lin, Physics
Taoyuan, Taiwan, Republic of China
Dissertation: A Theory of Electronic Energy States of Defects in Disordered Solids. (Under the direction of Gerald Lucovsky.)
- Carol Elaine Lorenz, Psychology
Victoria, Texas
Dissertation: The Influence of Expectations and Cohesiveness on the Performance of Small Groups: A Study of Quality Circles. (Under the direction of M. Henry Pitts and Donald W. Drewes.)
- Abdul Karim Makarim, Soil Science
Bogor, Indonesia
Dissertation: Effects of Land Reclamation Management Practices on Crop Production and Physical and Chemical Properties on a Tropical Soil. (Under the direction of D. Keith Cassel.)
- Denise Stratton McKenney, Microbiology
Hobbs, New Mexico
Dissertation: Isolation and Characterization of Mutants in *Azotobacter vinelandii* Affecting Acetate-Glucose Diauxie. (Under the direction of Thoyd Melton.)
- Howard Bart Mendelson, Mathematics
Glen Rock, New Jersey
Dissertation: Reductive Operators on a Separable Hilbert Space and the Invariant Subspace Conjecture. (Under the direction of Gary D. Faulkner.)
- Shankarlal Ranchhodbhai Mistry, Civil Engineering
Cary, North Carolina
Dissertation: Decomposition of Wastewater Organics in Soil. (Under the direction of Charles Smallwood, Jr.)
- Michael Alan Moss, Plant Pathology
Grenada, Mississippi
Dissertation: Epidemiology of Tobacco Blue Mold. (Under the direction of Charles E. Main.)
- Allan Frederick Nash, Horticultural Science
West Springfield, Massachusetts
Dissertation: Tomato Early Blight Resistance Derived from *Lycopersicon hirsutum* Humb. and Bonpl. P. I. 126445. (Under the direction of Randolph G. Gardner and Warren R. Henderson.)
- David Stanley Nelson, Chemical Engineering
Lenoir, North Carolina
Dissertation: Effects of Low Dosage Electron Irradiation on Kraft Pulp-
ing and Papermaking Properties of Southern Pine Wood. (Under the direction of Vivian T. Stannett.)
- Kyung Ae Park, Sociology
Jeonju, Korea
Dissertation: Sex Differentials in Cardiovascular Mortality: An Ecological Analysis. (Under the direction of William B. Clifford.)

- Edgar David Peebles III, Physiology
Raleigh, North Carolina
Dissertation: Factors Affecting Broiler Hatching Egg Production. (Under the direction of John T. Brake.)
- Martin Roy Peterson, Statistics
Morgantown, West Virginia
Dissertation: Closed Form Estimators and Small Sample Size Mean and Variance Approximations for Simple Linear Logistic Analysis. (Under the direction of Allison R. Manson.)
- Mansur Rastani, Mechanical Engineering
Tehran, Iran
Dissertation: Optimization of Trustee with Nonuniform Elements by a Catalog Strategy Method. (Under the direction of Clarence J. Maday and John S. Strenkowski.)
- Linda Lobao Reif, Sociology
Durham, North Carolina
Dissertation: Farm Structure, Industry Structure and Socioeconomic Conditions: A Longitudinal Study in Economy and Society. (Under the direction of Ronald C. Wimberley.)
- Manop Reodecha, Industrial Engineering
Bangkok, Thailand
Dissertation: A Classification and Coding System for CAD/CAM Applications in the Electronics Industry. (Under the direction of John R. Canada and Han Bao.)
- Alfred Nicholson Riddle, Electrical and Computer Engineering
Rome, Georgia
Dissertation: Oscillator Noise: Theory and Characterization. (Under the direction of Robert J. Trew.)
- James Warren Rucker, Fiber and Polymer Science
Raleigh, North Carolina
Dissertation: Investigation of the 2,2'-Bipyridine Catalyzed Bleaching of Cotton Fibers with Peracetic Acid. (Under the direction of David M. Cates.)
- Ali Shamseldin Mohd. Salih, Materials Engineering
Mugrat, Sudan
Dissertation: Extrinsic Gettering of Impurities in Silicon via the Controlled Introduction of Misfit Dislocations. (Under the direction of George A. Rozgonyi.)
- Peter Santago II, Electrical Engineering
Raleigh North Carolina
Dissertation: A Composite Model and Convex Set Coding Technique for Time-varying Images. (Under the direction of Sarah A. Rajala.)
- Timothy Tobler Schilling, Crop Science
Atlanta, Georgia
Dissertation: Breeding Studies Utilizing Elite Peanut Germplasm. (Under the direction of Johnny C. Wynne.)

- Mahesh Kantilal Shah, Mechanical Engineering
Ahmedabad, India
- Dissertation: A Nonlinear Finite Element Analysis of Plane Strain and Axisymmetric Forging. (Under the direction of John A. Bailey.)
- Jodi Ruth Shann, Botany
Hackettstown, New Jersey
- Dissertation: The Uptake and/or Utilization of Two Simple Phenolic Acids by *Cucumis sativus*. (Under the direction of Udo Blum.)
- Stephen David Soileau, Toxicology
Spring, Texas
- Dissertation: Effects of Chlordecone and Chlordecone Alcohol on Isolated Ovine Erythrocytes. (Under the direction of Donald E. Moreland.)
- Man Shik Song, Nuclear Engineering
Seoul, Korea
- Dissertation: Analytical Predictions of Boiling Film Stability for Conditions Consistent with Light Water Reactor Degraded Core Conditions. (Under the direction of Paul J. Turinsky.)
- Gary Judson Stainback, Psychology
Raleigh, North Carolina
- Dissertation: Effects of Cognitive Self-instruction in the Increase of Anger Control for Verbally Aggressive Children. (Under the direction of Rachel F. Rawls.)
- Wayne Martin Thal, Plant Pathology
Wayne, Pennsylvania
- Dissertation: Quantitative Epidemiology of Alfalfa Leafspot Diseases. (Under the direction of E. Lee Campbell and Kurt J. Leonard.)
- Melvin Scott Thomson, Entomology
Raleigh, North Carolina
- Dissertation: Host Selection Diversity of *Trichogramma* Species. (Under the direction of Ronald E. Stinner.)
- Stefan Tord Thynell, Mechanical Engineering
Gothenburgh, Sweden
- Dissertation: Radiation Transfer in Absorbing, Emitting and Scattering Rectangular, Spherical and Cylindrical Enclosures. (Under the direction of M. Necati Ozisik.)
- Patricia Leslie Traynor, Genetics
Madison, Wisconsin
- Dissertation: Transcription of the S2 Plasmid and the Ribosomal Genes of Maize Mitochondria. (Under the direction of Charles S. Levings III.)
- Werasak Udomkichdecha, Fiber and Polymer Science
Bangkok, Thailand
- Dissertation: On the Compressional Behavior of Bulky Fiberwebs (Non-wovens). (Under the direction of Subhash K. Batra and Mansour H. Mohamed.)

- Odidika Christian Umeozor, Entomology
Uga, Anambra, Nigeria
- Dissertation: European Corn Borer (Lepidoptera: Pyralidae): Biology and Management on Maize in Eastern North Carolina. (Under the direction of John W. Van Duyn.)
- Naomi Wagner, Psychology
Raleigh, North Carolina
- Dissertation: The Interpretation of Nonverbal Cues by Learning Disabled and Normally Achieving Children. (Under the direction of Rachel F. Rawls and Cathy L. Crossland.)
- Mickey Man-Kui Wai, Marine, Earth and Atmospheric Sciences
Hong Kong
- Dissertation: Modeling the Effects of the Spatially Varying Sea Surface Temperature on the Marine Atmospheric Boundary Layer. (Under the direction of S. Pal S. Arya.)
- Michael Gerard Waldvogel, Entomology
New York, New York
- Dissertation: Geographic Variation in Oviposition Preference of *Heliothis virescens* (F.) (Lepidoptera: Noctuidae). (Under the direction of Fred Gould and George G. Kennedy.)
- Thomas Woodrow Wilson III, Fiber and Polymer Science
Greensboro, North Carolina
- Dissertation: Radiation Effects on the Dynamic Mechanical Properties of Epoxy Resins and Graphite Fiber/Epoxy Composites. (Under the direction of Raymond E. Fornes and Richard D. Gilbert.)
- Chi Keung Wong, Physics
Hong Kong
- Dissertation: Vibrational Properties of Glasses. (Under the direction of Gerald Lucovsky.)
- William James Zielinski, Zoology
Milwaukee, Wisconsin
- Dissertation: The Effect of Diel Variation in Food Availability on the Circadian Activity of Small Carnivores. (Under the direction of Roger A. Powell and Phillip D. Doerr.)

ALUMNI DISTINGUISHED PROFESSORS

<i>Name</i>	<i>School and Department</i>	<i>Date</i>
John F. Roberts	School of Agriculture and Life Sciences Department of Zoology	1986-89
Myron W. Kelly	School of Forest Resources Department of Wood and Paper Science	1986-89
William P. Tucker	School of Physical and Mathematical Sciences Department of Chemistry	1986-89
Anne C. Clapp	School of Textiles Department of Textile Management and Technology	1986-89

OUTSTANDING TEACHER AWARDS FOR 1985-86

<i>Name</i>	<i>School and Department</i>
C. Maurice Balik	Engineering Materials Engineering
David F. Culkin	Forest Resources Recreation Resources Administration
Richard C. Dillman	Veterinary Medicine Microbiology, Pathology, and Parasitology
Maurice H. Farrier	Agriculture and Life Sciences Entomology/Forestry
Dennis E. Garoutte	Physical and Mathematical Sciences Mathematics
Peyton B. Hudson	Textiles Textile Management and Technology
James W. Kalat	Education Psychology
Wendell H. McKenzie	Agriculture and Life Sciences Genetics
James M. Nau	Engineering Civil Engineering
Jon Frederick Ort	Agriculture and Life Sciences Poultry Science
Sastry G. Pantula	Physical and Mathematical Sciences Statistics
Kevin R. Pond	Agriculture and Life Sciences Animal Science
J. Patrick Rand	Design Architecture
Donald R. Rhodes	Engineering Electrical and Computer Engineering
Kenneth P. Vickery	Humanities and Social Sciences History
Harry C. West	Humanities and Social Sciences English
Linda R. Williams	Humanities and Social Sciences Sociology and Anthropology

Awards for Achievement 1985-1986

SCHOOL OF AGRICULTURE AND LIFE SCIENCES

Agriculture Council Outstanding Club Member Awards:

- Agronomy:* Mark W. Ross, Williamston
- Animal Science:* Karen M. Bulluck, Battleboro
- Biochemistry:* Lillian H. Rinker, Burlington
- Biological and Agricultural Engineering:* Science Curriculum—Gregory L. Gentry, Madison; Technology Curriculum—Phil M. Ross, Greensboro
- Biology:* Kirby A. Lewis, New Bern
- Agricultural Economics:* Mack L. Gay, III, Rocky Mount
- Food Science:* Anne E. Tieleman, Riner, VA
- Horticulture:* Robert W. Luther, III, Elizabeth City
- Medical Technology:* Melissa Petty, Henderson
- Microbiology:* Lisa A. Ransbottom, Wendell
- National Agri-Marketing Association:* Jeffrey C. Jennings, Elizabeth City
- Pest Management:* Ellen S. Blenk, Goldsboro
- Poultry Science:* Tony M. Musselwhite, Monroe
- Pre-Medical and Pre-Dental:* Richard Daw, Chapel Hill
- Pre-Veterinary:* David Anderson, Oakridge
- Wildlife Biology:* William M. Hester, Goldsboro

Agronomy

- Senior Highest Scholastic Average in Agronomy:* Raymond P. Garner, Roanoke Rapids
- American Society of Agronomy Award, Most Outstanding Senior:* Paula D. Woodall, Smithfield
- Agronomy Club Leadership Award:* Paula D. Woodall, Smithfield

Animal Science

- Most Outstanding Club Member:* Lucy H. Green, Hertford
- Most Outstanding Senior:* Kimberly D. Alphin, Kinston
- American Society of Animal Science Undergraduate Awards:* Steve W. Breeding, Raleigh; Mary G. Buck, Gates; Cynthia D. Burnett, Charlotte; Yvonne D. Carter, Shelby; Billie C. Cundiff, Apex; Glenn D. Detweiler, Hickory; Susan G. Emerick, Hillsborough; Kelli M. Ferris, Apex; Robert S. Hanes, Jr., Raleigh; Kim F. Helmink, Durham; Joel L. Johnson, Morrisville; Stephen M. Jones, Pittsboro; Frances M. Kelly, Biscoe; Thomas B. Moss, Enfield; Daniel J. Petrus, Raleigh; Martha B. Shannon, Rocky Mount; Mary R. Smith, Rocky Mount; Audrey L. Thabet, Berkeley Heights, NJ; Ryan D. Weeks, Dunn

Biochemistry

- Outstanding Biochemistry Student Award:* Laura J. Benecki, Raleigh

Biological and Agricultural Engineering

- American Society of Agricultural Engineers, Student Honor Awards, Student Branch of ASAE:* Linda L. Blalock, Raleigh; Beth L. Reynolds, Robbins
- Agricultural Engineering Technology Club:* Gary R. Hamrick, Bostic; Alston W. Spruill Jr., Oriental

Botany

- Most Outstanding Student:* Melanie C. Trull, Monroe

Food Science

- B. M. Newell Award:* Anne E. Tieleman, Riner, VA
- Most Outstanding Senior:* Anne E. Tieleman, Riner, VA

Forbes Leadership Award: Sally L. Smith, Lexington
Ambrosia Chocolate Top Scholar Award: Sara E. McCauley, Durham
Crouch Scholastic Achievement Award: Patricia R. Butcher, South Africa; Lisa B. Hansen, Garner

Horticultural Science

Outstanding Senior Horticulturist Award: Katherine L. Kearse, Charlotte

Microbiology

Most Outstanding Student: Uma K. Nathan, Cary

Poultry Science

T. T. Brown Poultry Science Club Award: Ralph A. Keel, Robersonville

Zoology

Most Outstanding Student: Maury L. Edwards, Whitakers

SCHOOL OF DESIGN

The American Institute of Architects School Medal: John Scott Crowe, Denver

The American Institute of Architects Certificate of Merit: Thomas Allen Fisher, Northampton, MA

Alpha Rho Chi Medal: Cooper Gabriel, Gibsonton, FL

North Carolina Chapter of The American Institute of Architects Book Award: Michael George Stevenson, Henderson

Walter Hook Book Award: David Lyles Francis, Raleigh

Architecture Faculty Book Award: Richard Charlton Lewis, Clemmons

The American Society of Landscape Architects Certificate of Honor: Catherine Ann Alguire, Raleigh; Paula Faye Gornto, Durham

The American Society of Landscape Architects Certificate of Merit: Timothy Rusch Newell, Raleigh

North Carolina Chapter of The American Society of Landscape Architects Book Award: Sharron Cathy Scroggin, Eutaw, AL

Landscape Architecture Faculty Award: Daniel Anthony Howe, Raleigh; Jeffrey Burr Evans, Raleigh

The Industrial Designers Society of America Student Award: Billy S. Ingram III, Jamestown

Product Design Book Award: Brian Whitfield Laffitte, Tallahassee, FL; Thomas Matthew Baum, Kitty Hawk

Visual Design Book Award: Bruce Williams Whipple, Winston-Salem; Wendy Ann Wichtrich, Cary

Royal Society of Arts Silver Medal Criteria: acknowledged excellence in Textile Design, recognition of academic achievement, participation in and contribution to the life of the University: Bonny Mendenhall Calloway, Wake Forest

Orton A. Boren Service Award: Cooper Gabriel, Gibsonton, FL

SCHOOL OF EDUCATION

Education Council Outstanding Senior Awards:

Agricultural Education: James Thomas Skinner, Sims

Health Occupations Education: Jeanette Jenkins Iacona, Ellerbe

Industrial Arts Education: Daniel Richard Waters, Danville, VA

Industrial and Technical Education: Theodore Joseph Branoff, Zebulon

Mathematics Education: Jill Karen Thompson, Raleigh; Diane Marie Baetz, Charlotte

Psychology (outstanding graduating senior): Carol Lamb Resar, Raleigh

Psychology (general option): Kathleen Cyr Townsend, Washington, DC

Psychology (human resource development option): Edward Lee Thomas, Wilmington, NC

Science Education: Nancy Elizabeth Bunn, Raleigh

Agricultural Education Awards to Most Outstanding Seniors:

Fall 1985: Yolanda Iris Byrd, Staley

Spring 1986: Barry Wilson McKee, Fallston

Alpha Pi Chapter, Epsilon Pi Tau Leadership Award: Arthur John Koop, Raleigh

Durwin M. Hanson Achievement Award: Christopher Warren Hood, Vale

Psychology Department Award for Academic Achievement: Frederick Coston Beddingfield, Hendersonville

Psychology Department Award for Service to the Department: Mary Beth Ballard, Fuquay-Varina

Service Award to Outstanding Teacher in Science Education: Charlene W. Fields, Raleigh

Service Award to Outstanding Teacher in Mathematics Education: Jackie S. Ford, Raleigh

SCHOOL OF ENGINEERING

Engineering Senior Award for Scholarly Achievement: Alan Hedgecock Clark, Greensboro (Electrical and Computer Engineering)

Engineering Senior Award for Citizenship and Service: Kathleen McKinney Rau, Cary (Industrial Engineering)

Engineering Senior Award for the Humanities: Troy A. Doby, Jr., Raleigh (Civil Engineering/Computer Science)

Engineering Senior Award for Leadership: Virginia D. Jones, Raleigh (Civil Engineering)

Biological and Agricultural Engineering

Agricultural Council Outstanding Club Member Award for Biological and Agricultural Engineering—Science Curriculum: Gregory Leland Gentry, Madison

American Society of Agricultural Engineers Student Honor Awards—Student Branch of ASAE: Linda Liles Blalock, Raleigh; Beth Lola Reynolds, Robbins

Chemical Engineering

Eastern North Carolina Section of AIChE Outstanding Senior Award: Gary L. Gilleskie, Durham

Chemical Engineering Senior Award for Outstanding Contributions to Chemical Engineering: Jeffrey A. Buffo, Germantown, MD

The Peter V. Danckwerts Senior Project Award: David M. Sudano, Raleigh

The E. M. Schoenborn Graduate Student Award: David M. Hitch, Atlanta, GA

Civil Engineering

American Society of Civil Engineers, The Outstanding Senior Award: Virginia Duskin Jones, Raleigh

American Society of Civil Engineers Senior Awards: David Andrew Nailor, Durham; Robert Wayne Stocks, Raleigh; Fred Merton VanTassel, Raleigh

Associated General Contractors Award to Outstanding Senior in Civil Engineering/Construction Option: Joseph McPhail Hatcher, Jr., Fayetteville

Outstanding Teaching Assistant Awards: Wael Suleiman Arafat, Nablus, Jordan; Charles Michael Bullard, Sophia; Soteria Andrea Kokkinou, Nicosia, Cyprus

Electrical and Computer Engineering

Outstanding Electrical Engineering Senior Award: Gregory Stuart Whitcomb, Cary

Outstanding IEEE Student Award: Christopher Howard Jolly, Charlotte

Engineering Operations

Outstanding Senior Award: Wesley Kerley

Furniture Manufacturing and Management

Rudolph Willard Award, Outstanding Senior in Furniture Manufacturing and Management: David Stephen Miller, Buffalo, NY

Industrial Engineering

Outstanding Senior in Industrial Engineering: Kathleen McKinney Rau, Cary

Materials Engineering

Outstanding Senior Award: Jeffrey Wayne Honeycutt, Raleigh

Mechanical and Aerospace Engineering

American Society of Mechanical Engineers Certificate of Award for Outstanding Student Member: John Sloan Carney, Sanford

American Institute of Aeronautics and Astronautics Outstanding Achievement Award: Christopher J. Riley, Newton

American Institute of Aeronautics and Astronautics Chairman Certificate: John Robert Olds, Spartanburg, SC

Nuclear Engineering

Outstanding Senior Award: Joseph Ben Stroup, Cherryville

SCHOOL OF FOREST RESOURCES

Forestry

Biltmore Scholarships: David G. Cole, Hickory; Donald Lynn Jenkins, Wake Forest; Amy K. Kluttz, Mount Pleasant; Nancy L. Martin, Cary; William J. Stayton, Wake Forest; Timothy W. Tabak, Raleigh

Ralph C. Bryant Scholarship Award: David W. Fogarty, Raleigh

E. F. Conger Scholarship: Kimala Leigh Dills, Morrisville; Christopher F. Dumas, Wilmington; Adrian Link Thrower, Raleigh

James L. Goodwin Award: Gwen W. Amick, Ann Arbor, MI; Jody T. Brady, Raleigh; Russell S. Burgess, Boonville; William Andrew Casey, North Wilkesboro; Barry T. Ellenburg, Rutherfordton; Paul T. Eriksson, Ledgewood, NJ; Timothy R. Eudy, Albemarle; David F. Fogarty, Raleigh; John H. Grogan, III, Raleigh; Larry E. Ridenhour, Cary; Ian C. Shannon, Sharon, MA; Edward W. Sontag, Alexandria, VA; Roger D. Stallard, Maggie Valley; Gwen O. Trueblood, Hertford; Ronald F. West, Jr., Andrews

Jonathan Wainhouse Memorial Scholarship Award: Charles Reed Allen, Charlotte; James W. Hauser, Raleigh

George C. Slocum Award: W. Roy Cloninger, Raleigh

Westvaco Corporation (Minority): Jerold Marcellus Bryant, Georgetown, SC

Daniel Boone Conservation League, Inc.: Samuel C. Beavans, Jr., Raleigh

Wood and Paper Science

Pulp and Paper Technology

Alonzo Aldrich Scholarship: Richard A. Venditti, Monroe, CT

Dietrick Asten Scholarship: Mark S. Keller, Seven Valleys, PA

William E. Caldwell Scholarship: Kathleen Carrell, Pensacola, FL

Lawrence H. Camp Scholarship: Alan J. Watters, Chesterfield, VA

J. Robert Carpenter Scholarship: Janet Ann Black, Atlanta, GA

Drs. Li-Sho & Lee-Fun Chang Scholarship: Jasdev S. Gill, Augusta, GA

Charles W. Coker, Sr. Scholarship: Gerald W. Marks, Cameron

Continental Forest Industries Scholarship: David A. Hyer, Blakes, VA

E. E. Ellis Scholarship: James H. Caudill, Clemmons

Robert G. Hitchings Scholarship: Tony L. Baker, Hope Mills

International Paper Company Scholarship: David C. Holt, Charlotte

John R. Kennedy Scholarship: Brian R. Szafranski, Hopewell, VA

Nalco Chemical Company Scholarship: Marianne C. Rhodes, Lynchburg, VA

Sture G. Olsson Scholarship: Scott P. LeGrand, Richmond, VA

Harry H. Saunders Scholarship: John E. Garnett, Greenwich, CT

Salesmen's Society to Dixie Pulp & Paper Mills Scholarship: Roger W. Nussman,

Matthews

Dr. Fred B. Schelhorn Scholarship: Clinton D. Hester, Kernersville

Showlin Family Scholarship: James A. Krozser, Raleigh

Ray Smith Scholarship: Gavin L. Gaynor, Hawesville, KY

Southeastern Paper Industry Management Association Award: Robert C. Blohm, Atlanta, GA

Southern Paper Industry Management Association Award: James E. Bradbury, Lufkin, TX

Stone Container Corporation Scholarship: Timothy A. Nuckols, Glen Allen, VA

Dwight J. Thompson Scholarship: Christopher L. Gore, Nakina

Vinings Chemical Corporation Scholarship: Jennifer Ann Scott, Augusta, GA

Weyerhaeuser Foundation Endowed Scholarship: Stacy R. Lee, Ernul

Wood Science & Technology

Carolina Canadian Lumber Sales Scholarship: George T. Vann, Conway

N.C. Wood Preserver's Association Scholarship: Charles N. O'Quinn, Jr., Raleigh

Weyerhaeuser Company Scholarships: Annette F. Augustine, Raleigh; Joseph T. Roberts, Raleigh; Mikki R. Overmann, Liberty; Kenneth W. Odom, Jr., Severn

Alumni Scholarships: David C. Evans, Wallace; Kevin D. Griffin, Williamston

Recreation Resources Administration

Thomas I. Hines Outstanding Senior in Recreation: Susan Gail Saunders, Troy

SCHOOL OF HUMANITIES AND SOCIAL SCIENCES

Highest Scholastic Achievement Award: Humanities: David Creech Webb, Raleigh

Highest Scholastic Achievement Award: Social Sciences: Alma Hayes Biagini, Raleigh

Outstanding Senior Award: A. Jay Everette, Wilmington

SCHOOL OF PHYSICAL AND MATHEMATICAL SCIENCES

School Awards to Outstanding Seniors

Scholarship: Keith Steven Promislow, Charlotte

Leadership: Michael David Gildner, Raleigh

Citizenship: David Widiah Koury, Sanford

Humanities: Barbara Alis Prillaman, Greensboro

Departmental Awards

Chemistry

The North Carolina Institute of Chemists' Outstanding Student Award: Christie Ann Hopkins, Raleigh

The Merck Index Awards for Scholastic Achievement in Chemistry: Gray William Rushin, Rochester Hills, MI

The CRC Press Freshman Chemistry Achievement Award: Kevin Brian Hewett, Greenville

The 1986 Undergraduate Award in Analytical Chemistry: Nata Farah Samaha, Raleigh

Computer Science

The W. A. Brown Instruments, Inc. Senior Scholastic Achievement Award: Barry Taylor Henderson, Ellerbe

The W. A. Brown Instruments, Inc. Sophomore Scholastic Achievement Award: John William Snyder, Cary

Physics

Outstanding Graduating Senior in Physics: Keith Steven Promislow, Charlotte

Statistics

Outstanding Graduating Senior in Statistics: Christina Dewey Keene, Raleigh

Mathematics

Outstanding Graduating Senior in Mathematics: Keith Steven Promislow, Charlotte

John Cell Scholarships: Bryan Joseph Kincaid, Lenoir; An Chul Yoon, Raleigh

Carey Mumford Scholarship: Keith Steven Promislow, Charlotte

Mary Alice and Hubert V. Park Scholarship: William Phillip Setzer, Hickory

Jack Levine-Charles Anderson Award: John Reid Hauser, Raleigh
John Cell Freshman Scholarship: John McKinley Kirby II, Charlotte

Marine, Earth and Atmospheric Sciences

Faculty Prize for Outstanding Senior in Geology/Geophysics: Phillip Daniel Royall, Banner Elk

Award for Academic Achievement by a Senior in Geology/Geophysics: Dona Elizabeth Shaw, Chapel Hill

Faculty Prize for Outstanding Senior in Meteorology: Ray Paul Young, Cary
Conoco Undergraduate Scholarship in Geophysics: Trevor Anthony P. Bannister, Raleigh

John M. Parker III Geology Field Camp Scholarship: Kimbel Tracy Caulk, Hemlet; Phillip Daniel Royall, Banner Elk; Dona Elizabeth Shaw, Chapel Hill

SCHOOL OF TEXTILES

Joseph D. Moore Honor Award: Cynthis L. Hixon, Winston-Salem

Harry Ball Honor Award: L. Carol Tomasino, Raleigh

Lawrence Iason Honor Award: Joseph D. Atkins, Belmont

Chester H. Roth Honor Award: Edward H. Knox, Raleigh

John M. Reeves Scholarship: S. Machell McCourry, Conover

Murray Frumkin Honor Award: Carl E. Crowder, Jr., Reidsville

Textile Veterans Association Honor Award: Jane A. Matthews, Stokesdale

John E. Reeves Award: Perry A. Saunders, Wilmington

Donald F. McCullough Award: Cathryn D. Jones, Raleigh

John N. Gregg Award: Gina R. Miller, Fayetteville

American Association of Textile Chemists & Colorists Award: Patrick E. Hawks, Yadkinville

Phi Psi Textile Fraternity Award: Katherine E. Kever, Granite Falls

American Association for Textile Technology Award: Gregory H. Cranford, Troy

Sigma Tau Sigma Scholarship Fraternity Award: Cynthia L. Hixon, Winston-Salem

Kappa Tau Beta Student Leadership Award: Katherine M. Kuharcik, Wilmington

Delta Kappa Phi Textile Fraternity: David F. Cooper, Fayetteville

Henry A. Rutherford Honorary Award: Doris L. Pierce, Clayton

The Dean's Award: Katherine M. Kuharcik, Wilmington

ALUMNI ATHLETIC AWARD

Debbie Mulligan, Cary

THE HONOR SOCIETY OF PHI KAPPA PHI

Awards for 1986

Intellectual Achievement, Ph.D. Candidates: Linda L. Reif; Abdelfateh M. Yacout; Kyoo-Sik Bae

Intellectual Achievement, Masters Candidate: Gary J. Kirkpatrick

Intellectual Achievement, Senior Candidates: Robert C. Blohm; Alan H. Clark; Gary L. Gilleskie; Catherine M. Gordon; Cynthia L. Hixon; Paul G. McKee; Amy F. Moorman; Robin D. Parsons; Eva C. Pickler; Christopher J. Riley; Kevin V. Tracy; Melanie C. Trull

Intellectual Achievement, Junior Candidates

Joel K. Budd, Jr.; Walton J. Conway; Jack R. Edwards, Jr.; Gary A. Huber; Scott S. Lund; Frederick R. Indermaur; Zhu Peng; Lillian H. Rinker; Sheila J. Stone; Amy K. Stout

Intellectual Achievement, Sophomore Candidates: Kelly L. Berkstresser; Brian H. Camp; Kelly M. Carter; Mark B. McCoy; Robert L. Mickey; Michael D. Neaves; Ninette Y. Ribet; Richard L. Williams

GOLDEN CHAIN HONOR SOCIETY MEMBERS FOR 1985-86

Sarah Louise Dolby
Octavius Charles Harriss
Cynthia Lynn Hixon
Anita Sue Heavner
Laura Jane Benecki
Laurie Dunlap Scotton
Arthur Jay Everette
Lisa Carol Gardner
Catherine Mason Gordon
Beth Ann Heiney
Kimi Eugenia Jones
James Todd Williams

AIR FORCE ROTC AWARDS

Society of the War of 1812: Thomas C. Moore
Air Force Association Award: Bobby A. Ingle
Am. Legion—Military Excellence—AS 400 (gold): Phillip R. Devoe
American Legion—Military Excellence—AS 300 (gold): Roy T. Ellis
American Legion—Military Excellence—AS 200 (silver): John R. Watson
American Legion—Military Excellence—AS 100 (bronze): Lawrence E. West
American Legion—Scholastic Excellence—AS 400 (gold): Donald P. Duckett
American Legion—Scholastic Excellence—AS 300 (gold): Lynn W. Evans
American Legion—Scholastic Excellence—AS 200 (silver): Joseph Y. Parker
American Legion—Scholastic Excellence—AS 100 (bronze): Linda R. Edwards
Daughters of Founders and Patriots of America: Victor M. Floyd
Daughters of the American Revolution: Michael T. Brewer
Reserve Officers Association—AS 400: Debra A. Harris
Reserve Officers Association—AS 300: Richard A. Gibson
Reserve Officers Association—AS 200: Kelvin H. Van Hall
American Defense Preparedness Association: Jeffrey N. Ross
Military Order of the World Wars—AS 300: Charles S. Joyce
Military Order of the World Wars—AS 200: William M. Tart
Military Order of the World Wars—AS 100: William K. Rogers
Veterans of Foreign Wars—AS 400: Brian M. Killough
Veterans of Foreign Wars—AS 300: Kenneth S. Klawon
Veterans of Foreign Wars—AS 200: William J. Compton
Veterans of Foreign Wars—AS 100: Thomas J. Ramsey
National Sojourners: William J. Compton
Retired Officers Association: Charles S. Joyce
Sons of the American Revolution: Scott A. Hunter
Armed Forces Comm & Electr Assn Award (AFCEA): David J. Diserafino
General Dynamics: Eric G. Hansen

ARMY ROTC AWARDS

Department of the Army Superior Cadet Award: Mary M. Mills; Gregory W. Washington; Terryne F. Murphy; Mark D. Chapman
American Logistics Association Award: Robert A. Boyette
American Defense Preparedness Association Award: Todd G. Kallam
Association of the United States Army Award: Robert A. Boyette
Reserve Officers Association Award: Blair L. Hawkins; Brian R. Hinkle; Joseph K. Roberts
American Legion Award for General Military Excellence: Robert T. Johnson; Kurt D. Schmidt
American Legion Award for Scholastic Excellence: Garland H. Goodrich; Robert J. Gaskin

Veterans of Foreign Wars Award: Kimberly D. Chavis
American Veterans of World War II, Korea and Vietnam Award: Cassandra D. Mudd
National Sojourners Award: Lynda D. Friede
Sons of the American Revolution Award: Steven T. McGugan
Military Order of the World Wars Award: Jeffrey L. Sasser; Richard C. Dyer; James T. Hall; Larry N. Cookman
Daughters of the American Revolution Award: Susan M. Dermer
Daughters of Founders and Patriots of America Award: Woodrow O. Wilson III
George C. Marshall ROTC Conference Representative Winner: Mark D. Chapman
Legion of Valor Bronze Cross Award: Garland H. Goodrich
Society of the War of 1812: Brian K. Harris
Retired Officers Association Award: Carl W. Ramsey

NAVY ROTC AWARDS

The General Dynamics Award: MIDN 1/C Jeffrey M. Donaldson
The Daughters of the American Revolution Medal: MIDN 1/C Jeffrey M. Donaldson

Air Force ROTC Commissionees

DECEMBER 1985

Sara E. Baker	Greenville
Steven J. Boykin	Wendell
Christopher D. Cotts	Alexandria, VA
Steve D. Hepler	Lewisville
Raymond D. Leadbetter	Kernersville
Neal C. Phillips	Bear Creek
James R. Robenolt	Raleigh
Kenneth W. Stallings	Rocky Mount
Joseph V. Vohwinkel	Charlotte

MAY 1986

Leo C. Adams	Andrews
Ronald J. Agar	Forest, VA
David W. Baker	Creedmoor
Michael T. Brewer	Raleigh
Brett A. Colby	Morehead City
Anthony Cotton	Dudley
David W. Clemmer	High Point
Mary-Kay Davidson	Alexandria, VA
Phillip R. Devoe	Lillington
Debra A. Harris	Jacksonville
Patrick J. Kelley	Goldsboro
Daniel L. Marlowe	Asheville
James N. Miller	Cary
Stuart W. Ramsey	Hope Mills
Jack R. Rickman Jr.	Fayetteville
Jeffrey N. Ross	Burlington
Kerry M. Sullivan	Cary
Sandra L. Walker	Bernardsville
Andreas W. Walsh	Fayetteville
Douglas H. Welch	Charlotte
John B. White	Salemburg
Chet L. Whitley	Havelock

AUGUST 1986

Scott A. Rose	Smithfield
Craig A. Williams	Dunn

Army ROTC Commissionees

DECEMBER 1985

Kevin G. Lawrence Westerville, OH
 Timothy S. Means Kernersville

MAY 1986

Holly H. Barber Raleigh
 Michael T. Boone Garland
 Mark D. Chapman Junction City, OR
 Marty W. Coates Clarkton
 Larry N. Cookman Oxford
 Susan M. Dermer High Point
 Robert J. Gaskin Albemarle
 Reginald W. Hunter Fayetteville
 Todd G. Kallam Mayodan
 Christopher G. McGreevy Merrick, NY
 Erik S. Musselman Mocksville
 Sey S. Nam Fayetteville
 Paul H. Noblin, Jr. Raleigh
 James W. Renna Raleigh
 Joseph K. Roberts Kailua, HI
 Robert B. Rose Carrsville, VA
 Kurt D. Schmidt Wilson
 Alvin B. Starnes, III Faith
 Peter F. Versfeld Lawrenceville, NJ
 Vincent R. White Richmond, VA
 Ann T. Winders Raleigh

Navy ROTC Commissionees

NAVY AND MARINE CORPS MIDSHIPMEN

MIDN 1/C Jeffery M. Donaldson, Navy Charlotte
 MIDN 1/C Douglas H. Fairfield, Marine Corps Greensboro
 MIDN 1/C Thomas A. Hecmanezuk, Navy Akron, OH
 MIDN 1/C Keith W. Schellenberger, Navy Greensboro

NORTH CAROLINA

Agricultural Institute



University Student Center
North Carolina State University
May 9, 1986

T W E N T Y - F I F T H
A G R I C U L T U R A L I N S T I T U T E
E X E R C I S E S O F G R A D U A T I O N

School of Agriculture and Life Sciences

D. F. Bateman, Dean
Presiding

May 9, 1986
2:00 p.m.

*PROCESSIONAL

*INVOCATION Richard C. Brand, Jr.
Associate Minister
First Presbyterian Church
Raleigh, North Carolina

ADDRESS E. W. Glazener
Associate Dean and Director of Academic Affairs
School of Agriculture and Life Sciences
North Carolina State University

AWARDING OF DIPLOMAS D. F. Bateman, Dean
E. W. Glazener, Director of Academic Affairs
H. B. Craig, Associate Director of Academic Affairs
School of Agriculture and Life Sciences

STUDENT COMMENCEMENT SPEAKER David A. Hill

REMARKS Nash N. Winstead
Provost and Vice Chancellor
North Carolina State University

RECOGNITION OF MARSHALS D. F. Bateman, Dean

*BENEDICTION Richard C. Brand, Jr.

*RECESSIONAL

Reception Immediately Following the Graduation Ceremony

*Please Stand

AGRICULTURAL INSTITUTE GRADUATES

May 9, 1986

<u>AGRICULTURAL EQUIPMENT TECHNOLOGY</u>		<u>FLOWER AND NURSERY CROPS TECHNOLOGY (Continued)</u>	
**	Trent Ryan Cloaninger	* #	✗Mary Lynn Melvin
#	✗Michael Andrew Bell		Richard Lee Sales
*	Landon Brooks Peedin	*	Nathaniel Blakely Skenes
<u>AGRICULTURAL PEST CONTROL</u>		*	Darren Richard Tysinger
	Timothy Wade Smith		
<u>FIELD CROPS TECHNOLOGY</u>		<u>FOOD PROCESSING, DISTRIBUTION, AND SERVICE</u>	
	Philip Gregory Bowman		Lisa Michele Beavers
	Thomas Gene Edwards, Jr.	#	Gary Branson Ellis
✗	Archibald Kavanaugh Ellis, Jr.		Warren Louis Goodman
*	Ray Winston Ellis, Jr.	**	Kathy Hill Harwood
#	✗Alton Randolph Hamill	**	Tony William Medlin
#	Ashley Lynn Jones	*	✗William Jack Smith
#	✗Roger Lewis Jones		William Scott Strickland
**	Robert Edward Lee, Jr.		William Fred Williford
	Hobert George Woodham, Jr.		
<u>FLOWER AND NURSERY CROPS TECHNOLOGY</u>			<u>GENERAL AGRICULTURE</u>
*	Clancy Cleveland Baucom	**	Sidney Allen Berryman
	Michael Edward Dahle	#	✗John Samuel Blue, Jr.
#	✗Robert Scott Deans		Leland Duane Jackson
	Gregory Scott Ford	**	Mark Stephen Letcher
	Kenneth Eugene Kennedy, Jr.	**	Vernon Lee Miles
		**	Michelle Bakker Pridgen

LIVESTOCK MANAGEMENT AND
TECHNOLOGY

- Thomas Dean Askew
- * Robin Daniels Atkins
- # David Franklyn Aycoth
- ** Kevin Leon Brickhouse
- # /Lynn Ashley Cole
- Phillip Ray Elmore
- # /Jeffery Todd Faucette
- # /Thomas McAdams Holmes, Jr.
- # /Max Ralston James, Jr.
- Marc Edward Mitchum
- ** Daphne Elizabeth Pegram
- ** Fred Rountree Smith
- # /James Kendall Smith
- Thomas Leon Stroud, Jr.
- ** Timothy Ray Thomas
- Julia Kay Waller
- Michael Wade Wilson

TURFGRASS MANAGEMENT

- # /Harold Todd Armstrong
- # /Ryke Griggs Citty
- * Dyrck Alan Fanning
- ** # /Michael George Fridl
- ** Ronald Ray Gilmore

TURFGRASS MANAGEMENT (Continued)

- ** # Jacob Todd Hewlett
- # /Henry Clayton Jackson, Jr.
- Andrew Scott Jones
- ** Stephen Ray Long, Jr.
- ** # /Jack Kevin Mansfield
- # /Scott Carter Martin
- # /William Jeffrey Smith
- John Palmer Stainback, II
- ** #Michael Romey Triplett

DOUBLE MAJORS

- # Johnny David Adcock
- * # Steven Craig Beasley
- ** Michael Scott Black
- ** # Neil Bennett Covington, Jr.
- Gregory Eugene Crawford
- ** John Fulton Edmanson
- ** David Allen Hill
- Jennifer Diane Maxey
- * # Elwyn Todd McPeak
- # /Christopher Phillip Miller
- ** # Gary Edward Milton
- # /Curtis Smith Powell
- # /Jesse Luther Wilson, Jr.
- ** High Honors
- * Honors
- / In Absentia
- # Graduated December, 1985

MARSHALS

Linda Diane Davis

Gerald Christopher Conrad

Randall Allen Smith

Daniel Arthur Jones

John Andrew Clapp

Chad Clinton Blake



North Carolina State University **Bulletin**

summer sessions 1986



February 1986

DEFINITIONS OF ETHNIC GROUPS

White (not of Hispanic origin). Persons having origins in any of the original peoples of Europe, North Africa, or the Middle East.

American Indian or Alaskan Native. Persons having origins in any of the original peoples of North America, and who maintain cultural identification through tribal affiliation or community recognition.

Black (not of Hispanic origin). Persons having origins in any of the black racial groups.

Asian or Pacific Islander. Persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands. This includes for example, China, Japan, Korea, the Philippine Islands, American Samoa.

Hispanic. Persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race.



SUMMER SESSIONS 1986

**North Carolina State University
Raleigh, North Carolina**

SUMMER SESSIONS 1986 REGISTRATION APPLICATION INFORMATION

STUDENTS ELIGIBLE TO USE THE ENCLOSED SUMMER SESSIONS REGISTRATION APPLICATION:

Only Lifelong Education students are eligible to use the enclosed Summer Sessions Registration Application.

The Registration Application form *must* be used by all visiting students from other colleges or universities who will be classified as *Lifelong Education students* and by all students who are currently classified as Lifelong Education students at North Carolina State University.

A *Lifelong Education student* is one who has not been formally admitted as a degree candidate to North Carolina State University and does not wish regular classification of any kind at the University. See page 10, Lifelong Education Students, for additional information.

NOTE: All Lifelong Education students (including those from other universities and colleges) are advised that NCSU degree students are always given priority for Summer Sessions classes. *Acceptance of the Registration Application for Lifelong Education students by the Summer Sessions Office in no way constitutes a guarantee that class space will be available.*

STUDENTS NOT ELIGIBLE TO USE THE ENCLOSED SUMMER SES- SIONS REGISTRATION APPLICATION:

1. The Registration Application form is *not* to be used by any classified degree candidate, undergraduate or graduate, now attending North Carolina State University. Such students must preregister through their advisers (see page 13).
2. The Registration Application form is *not* to be used by any student who has previously enrolled as a degree candidate at North Carolina State University. Such students (former students returning) must apply for readmission to the University by writing to the Department of Registration and Records, North Carolina State University, Box 7313, Raleigh, North Carolina 27695-7313 (see page 13).

INFORMATION:

For additional information about the Summer Sessions write to:

The Director of Summer Sessions
North Carolina State University
Box 7401
Raleigh, N.C. 27695-7401

or call (919) 737-2265.

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NORTH CAROLINA STATE UNIVERSITY

ADMINISTRATION

Bruce R. Poulton, *Chancellor*
Nash N. Winstead, *Provost and Vice Chancellor*
William L. Turner, *Vice Chancellor for Extension and Public Service*
Thomas H. Stafford Jr., *Vice Chancellor for Student Affairs*
George L. Worsley, *Vice Chancellor for Finance and Business*
John T. Kanipe Jr., *Vice Chancellor for Development*
Albert B. Lanier Jr., *Director of University Relations*
Jasper D. Memory, *Vice Provost and Dean of the Graduate School*
Franklin D. Hart, *Vice Chancellor for Research*

DEANS OF THE SCHOOLS

Durward F. Bateman, *School of Agriculture and Life Sciences*
Claude E. McKinney, *School of Design*
Carl J. Dolce, *School of Education*
Larry K. Monteith, *School of Engineering*
Eric L. Ellwood, *School of Forest Resources*
William B. Toole, III, *School of Humanities and Social Sciences*
Garrett Briggs, *School of Physical and Mathematical Sciences*
Dame S. Hamby, *School of Textiles*
Terrence M. Curtin, *School of Veterinary Medicine*

SUMMER SESSIONS

William L. Turner, *Vice Chancellor for Extension and Public Service*
John F. Cudd Jr., *Director*
Nancy E. Polk, *Assistant Director*

ADMISSIONS

Anna P. Keller, *Director*

REGISTRATION

James H. Bundy, *University Registrar*

SUMMER SESSIONS CALENDARS

1986

FIRST SESSION (MAY 19-JUNE 25)

April 4	Friday	Last day to preregister
May 19	Monday	Registration/Change Day
May 20	Tuesday	First day of classes
May 21	Wednesday	Last day to add a course without permission of instructor
May 26	Monday	Last day to add a course; last day to withdraw or drop a course with a refund (NOTE: The tuition and fees charge is based on the number of hours and courses officially carried as of this date.)
May 30	Friday	Last day to withdraw or drop a course without a grade, or to change from credit to audit, at the 400 level or below
June 6	Friday	Last day to withdraw or drop a course at the 500 or 600 level without a grade
June 23	Monday	Last day of classes
June 24, 25	Tuesday, Wednesday	Final examinations

FIRST SESSION FINAL EXAMINATION SCHEDULE

Examination Times	0800-1100	1300-1600	1800-2100
	Hour Class Actually Begins During the Session		
Tuesday, June 24	0730, 0800, 0910	1140	1745
Wednesday, June 25	0950, 1020	1300, 1340	1915, 1945

SECOND SESSION (JUNE 30-AUGUST 7)

May 15	Thursday	Last day to preregister
June 30	Monday	Registration/Change Day
July 1	Tuesday	First day of classes
July 2	Wednesday	Last day to add a course without permission of instructor
July 4	Friday	Holiday
July 7	Monday	Last day to add a course; last day to withdraw or drop a course with a refund (NOTE: The tuition and fees charge is based on the number of hours and courses officially carried as of this date.)
July 11	Friday	Last day to withdraw or drop a course without a grade, or to change from credit to audit, at the 400 level or below
July 18	Friday	Last day to withdraw or drop a course at the 500 or 600 level without a grade
August 5	Tuesday	Last day of classes
August 6, 7	Wednesday, Thursday	Final examinations

SECOND SESSION FINAL EXAMINATION SCHEDULE

Examination Times	0800-1100	1300-1600	1800-2100
	Hour Class Actually Begins During the Session		
Wednesday, August 6	0730, 0800, 0910	1140	1745
Thursday, August 7	0950, 1020	1300, 1340	1915, 1945

TEN-WEEK SESSION (MAY 19-AUGUST 4)

April 4	Friday	Last day to preregister
May 19	Monday	Registration/Change Day
May 20 (21)*	Tuesday (Wednesday)	First day of classes
May 22 (26)*	Thursday (Monday)	Last day to add a course without permission of instructor
May 26	Monday	Last day to add a course; last day to withdraw or drop a course with a refund (NOTE: The tuition and fees charge is based on the number of hours and courses officially carried as of this date.)
June 10 (11)*	Tuesday (Wednesday)	Last day to withdraw or drop a course without a grade, or to change from credit to audit at the 400 level or below
June 17 (18)*	Tuesday (Wednesday)	Last day to withdraw or drop a course at the 500 or 600 level without a grade
July 4	Friday	Holiday
July 24	Thursday	Last day of classes for Tuesday/Thursday classes
July 28	Monday	Last day of classes for Monday/Wednesday classes
July 29	Tuesday	Final examinations for 1745, Tuesday/Thursday classes
July 30	Wednesday	Final examinations for 1745, Monday/Wednesday classes
July 31	Thursday	Final examinations for 1915, 1945 Tuesday/Thursday classes
August 4	Monday	Final examinations for 1915, 1945 Monday/Wednesday classes

*First day for Tuesday/Thursday classes. Date in parentheses for Monday/Wednesday classes.

TEN-WEEK SESSION FINAL EXAMINATION SCHEDULE

(As noted in the calendar above)

ADULT EDUCATION SESSION (JUNE 16-JULY 3)

June 16	Monday	Registration and first day of classes
June 17	Tuesday	Last day to add a course; last day to withdraw or drop a course with a refund (NOTE: The tuition and fees charge is based on the number of hours and courses officially carried as of this date.)
June 25	Wednesday	Last day to withdraw or drop a course without a grade
July 2	Wednesday	Last day of classes
July 3	Thursday	Final examinations

ADULT EDUCATION SESSION FINAL EXAMINATION SCHEDULE

(As noted in the calendar above)



Prominent in the above aerial of the central North Carolina State University campus are three high-rise residence halls (foreground), the circular Harrelson Hall with the adjacent towers of Cox and Dabney Halls, and in the upper left, the tower of the D. H. Hill Library. The central campus encompasses some 623 acres.

North Carolina State University

North Carolina State University is one of the nation's major public universities and shares the distinctive character of Land-Grant state universities nationally—broad academic offerings, extensive public service, national and international activities, and large-scale extension and research programs.

The University is organized in nine schools and the Graduate School. The nine schools are Agriculture and Life Sciences, Design, Education, Engineering, Forest Resources, Humanities and Social Sciences, Physical and Mathematical Sciences, Textiles, and Veterinary Medicine. In addition, a complex of divisions, institutes, and centers provides for a wide range of special academic, research, and extension programs.

Academic opportunities are provided in 89 fields leading to baccalaureate degrees, 75 master's degree fields and 48 fields leading to doctoral degrees.

Research activities span a broad spectrum of about 700 scientific, technological and scholarly endeavors.

Extension work on a statewide basis in each of the 100 counties and the Cherokee Indian Reservation carries the University's campus to the state's boundaries. Diverse extension activities are carried on by all nine schools and a number of specialized institutes and centers.

The University has approximately 5,600 employees. There are 2,700 faculty and other academic personnel, including 1,400 graduate faculty and 226 adjunct faculty.

There are 150 campus buildings on the central campus of 623 acres. In addition the University has acquired an adjacent property of 780 acres which will allow expansion. It has 88,000 acres on a statewide basis, including one research and endowment forest of 78,000 acres. Near the main campus are research farms; biology and ecology sites; genetics, horticulture and floriculture nurseries; forests; and areas such as Carter-Finley Stadium, which together comprise about 2,500 acres.

The University's Wolfpack athletic teams are well-known nationally. The basketball team was national champion in 1974 and 1983. The football team has been the Atlantic Coast Conference champion five times and co-champion twice and has won five bowl games. Numerous N. C. State athletes have won NCAA, national, and international honors, including medals in the last five Olympics. The Wolfpack women's intercollegiate cross-country team won national championships in 1979 and 1980. An N. C. State woman was the first woman to win the coveted ACC "Athlete of the Year" award in 1980, and she won it again in 1981 for her performances in distance running. A Wolfpack athlete won the first women's NCAA individual cross-country championship in 1981. The women's basketball and swimming teams also have ranked nationally.

North Carolina State University is one of the three Research Triangle Universities along with Duke University and the University of North Carolina at Chapel Hill. In the 30-mile triangle formed by the three universities is the 5,000-acre Research Triangle Park, the Research Triangle Institute (a Universities' subsidiary), and the Triangle Universities Computation Center, a central facility for the extensive computing activities of the institutions.

The University's total enrollment is more than 24,000, including approximately 16,900 undergraduate students, 3,350 graduate students, 3,300 Lifelong Education students and 500 students in other special categories. The total student population is made up of approximately 15,100 men and 8,900 women including 2,860 black or other minority students. Students come to N. C. State from nearly every state in the nation and at least 88 foreign countries are represented by more than 800 international students.

North Carolina State University is committed to equality of educational opportunity and does not discriminate against applicants, students, or employees based on race, color, national origin, religion, sex, age, or handicap. Moreover, North Carolina State University is open to people of all races and actively seeks to promote racial integration by recruiting and enrolling a larger number of black students.

NCSU is a member of the National Association of State Universities and Land-Grant Colleges, the American Council on Education, and the American Council of Learned Societies.

THE SUMMER SESSIONS

The Summer Sessions at North Carolina State University offer an extensive educational program planned to meet the varied needs and interests of approximately 13,000 students. Sixty departments offer instruction in more than 700 courses, approximately 90% of which are at the undergraduate level.

Each of the University's nine schools, with a combined faculty of more than 500, participates in the Summer Sessions. The schedule includes two "regular" five-week sessions, a ten-week session, and a three-week institute for adult and extension educators, as well as several dozen evening courses scheduled for the convenience of working adults.

Summer courses and special programs are designed for the new student, the undergraduate wanting to advance his or her academic standing at State, the graduate desiring to continue study and research during the summer months and for visiting students pursuing degrees at other institutions. Teachers who need to earn credit toward renewal of teaching certificates or advanced degrees in education and persons in professional fields who wish to keep abreast of new developments and trends also take advantage of State's summer programs.

ADMISSIONS

North Carolina State University is committed to equality of educational opportunity and does not discriminate against applicants, students, or employees based on race, color, national origin, religion, sex, age, or handicap. Moreover, North Carolina State University is open to people of all races and actively seeks to promote racial integration by recruiting and enrolling a larger number of black students.

Students are admitted to the summer sessions in one of seven categories: 1) new freshmen, 2) new undergraduate transfer students, 3) new graduate students, 4) Lifelong Education students, 5) continuing North Carolina State University students, 6) former North Carolina State University students, and 7) suspended North Carolina State University students.

NEW FRESHMEN

Application forms for new freshmen should be obtained from the Director of Admissions, NCSU, Box 7103, Raleigh, North Carolina 27695-7103. The Summer Sessions application form in this bulletin should *not* be completed. Applications should be submitted in the fall of the senior year in high school. The application deadline is May 1. Based on past experience, applications and credentials received in the fall and early winter have received full consideration while those applications received later may be subject to a waiting list. A freshman applicant should be a graduate of an accredited secondary school. Nongraduates should have a high school equivalency certificate. The following high school preparation, or its equivalent, is necessary: English, 4 units; history or social studies, 2 units; mathematics, 2 units in algebra, 1 unit in geometry, and 1 unit in advanced math is strongly recommended for the Schools of Engineering, Physical and Mathematical Sciences, and Forest Resources; science, 2 units, preferably biology, chemistry, or physics; foreign language, 2 units recommended but not required, for the School of Humanities and Social Sciences only.

Freshman applicants must take the Scholastic Aptitude Test of the College Entrance Examination Board. These scores, together with the high school record, will be considered in determining admissibility. Information as to the

time and place at which the Scholastic Aptitude Test will be given may be obtained from high school guidance counselors, or by writing directly to the College Entrance Examination Board, Box 592, Princeton, New Jersey 08540 for the *Bulletin of Information*. The *Bulletin* includes an application form and is available without charge. Test scores from the ACT (American College Test) may be submitted in lieu of the SAT.

Although the Achievement Test scores are not used in the admission decision, the English and Math Level I Tests are recommended for proper course placement. Additional information concerning these tests may be obtained by contacting the Undergraduate Admissions Office (919-737-2434).

NEW TRANSFER STUDENTS

THE FOLLOWING INFORMATION REPRESENTS A MAJOR CHANGE IN NCSU'S TRANSFER ADMISSION POLICY.

Students seeking transfer admission into a degree program should obtain an application from the Office of Undergraduate Admissions and submit it before May 1. These students should not complete the Summer Sessions application in this bulletin.

Priority will be given to students presenting 60 or more semester hours of "C" or better work on courses which are applicable to the degree program to which they are applying. The minimum overall grade point average required for transfer admission is 2.0; programs which are experiencing space limitations require a higher GPA.

Individual official transcripts must be submitted from each institution attended. Students must be eligible to return to the last institution attended. College credits must have been earned at an accredited institution and should include a college-level math or the high school record must be submitted to show proper background.

NEW GRADUATE STUDENTS

All students working towards advanced degrees are enrolled in the Graduate School. An application for admission may be obtained from the Dean of the Graduate School, Box 7102, NCSU, Raleigh, North Carolina 27695-7102.

STUDENTS ADMITTED TO THE FALL SEMESTER

Any student accepted for regular admission for the fall semester wishing to attend either summer session should notify the Admissions Office, to change the date of entrance. He or she should *not* complete a Summer Sessions application.

LIFELONG EDUCATION STUDENTS

Lifelong Education students must complete the Summer Sessions Registration Application in the front of this bulletin. A Lifelong Education student is one who has never been formally admitted as a degree candidate at North Carolina State University. All students visiting from other schools will be classified as Lifelong Education students.

Lifelong Education Students—Undergraduate Studies (UGS)—This classification is used for individuals who have not obtained a baccalaureate degree and who wish to take courses but who are not currently admitted to a degree program. To

be eligible for acceptance as an Undergraduate Lifelong Education Student, for the Summer Sessions an individual should:

- a. have acquired a high school diploma or GED certificate; and
- b. not be a degree candidate at North Carolina State University; or
- c. be a high school student who has been recommended by his/her school and approved by the Office of Admissions to take lower level courses.

Post-Baccalaureate Studies (PBS)—The Post-Baccalaureate Studies (PBS) classification is designed for U.S. citizens who wish to undertake academic work beyond the baccalaureate degree but who are not currently admitted to a degree program. This classification is not open to foreign nationals with the exception of the spouse of a regularly enrolled NCSU student. In special cases where students are sponsored by an agency of the U. S. Government for specialized, non-degree study, approval may be given by the Graduate School for registration in the Post-Baccalaureate Studies classification. The following policies apply to students who wish to register for PBS:

1. All must have baccalaureate degrees from accredited institutions of higher education.
2. All classes taken for credit by PBS students will be graded in the usual manner that applies for the particular course (A, B, C, D, NC or S, U). All courses taken at NCSU will show on the student's transcript. If the student is admitted as a graduate student, a maximum of nine hours may apply toward the minimum requirements of the degree for which the student is enrolled. Only the *first* nine hours of course work taken at the graduate level in the PBS category can be accepted toward degree requirements unless a request for some other combination of nine hours is made by the student's advisory committee and approved both by the School Dean and the Graduate Dean.
3. The Grade Point Average (GPA) of a graduate student who has credits in the PBS category will be based on all courses taken at the 400-600 level. However, no course taken six (6) years prior to enrollment into a program will be considered in the GPA calculation.
4. Registration is limited to a maximum of two courses per session. Individuals who are employed fulltime should limit their PBS registration to one course per session.
5. The PBS classification carries with it no implication that the student will be admitted to the Graduate School in any degree classification.
6. All course work accepted for degree credit must be approved by the student's advisory committee as being germane to the program. Requests for degree credit for courses completed in the PBS classification are considered after admission to a graduate degree program when the student's Plan of Graduate Work is filed with the Graduate School.
7. PBS students are expected to familiarize themselves with Graduate School policies and to seek further advice or clarification as needed.

Limitations—Persons found eligible to study as Lifelong Education students are not to assume that they have received formal admission to the University as either undergraduate or graduate degree candidates. To become a degree candidate, formal application must be made through the Undergraduate Admissions Office or the Graduate School. Undergraduate Lifelong Education students may not register for more than two academic courses plus one physical education course per summer session.

Course Availability—Persons found eligible may register for any course offered by the University, provided they satisfy the required course prerequisites and classroom space is available.

Academic Standards—The academic standards applicable to undergraduate students at the University also apply to Lifelong Education students.

CONTINUING NCSU DEGREE STUDENTS

Any regular NCSU degree candidate may attend the Summer Sessions. The *Summer Sessions application in this bulletin must not be completed*, but registration procedures as listed on page 13 must be followed.

READMISSION OF FORMER NCSU DEGREE STUDENTS

Former NCSU degree students who wish to attend the Summer Sessions must apply for readmission through Registration and Records at least 30 days prior to the intended date of return. The readmission application may be obtained by writing to the Department of Registration and Records, NCSU, Box 7313, Raleigh, N.C. 27695-7313. *The Summer Sessions application in this bulletin must not be completed*, but registration procedures as listed on page 13 must be followed.

SUSPENDED NCSU DEGREE STUDENTS

NCSU degree students suspended at the end of the spring semester, 1986, may attend one or both sessions of the Summer Sessions to become eligible to continue in the fall. *The Summer Sessions application in this bulletin must not be completed*, but registration procedures as listed on page 13 must be followed. Students suspended prior to the spring semester, 1986, may attend one or both sessions of the Summer Sessions but should follow readmission procedures. The readmission application may be obtained by writing the Department of Registration and Records, NCSU, Box 7313, Raleigh, N.C. 27695-7313.



REGISTRATION PROCEDURES

PREREGISTRATION

All students who plan to attend the Summer Sessions must preregister. Preregistration consists of selecting the courses to be taken during the Summer Sessions and filing a Preregistration Schedule Request Form with Registration and Records. Each student who preregisters will be allowed to *complete registration by mail* if tuition and fees have been paid by the deadline. The preregistration period for all students will begin on Monday, March 24, 1986. The deadlines for preregistration will be:

First Summer Session and the Ten-Week Session—Friday, April 4, 1986
Second Summer Session—Thursday, May 15, 1986

Currently enrolled degree students will preregister for the Summer Sessions at the time they preregister for the 1986 fall semester.

Former degree students returning may preregister for the Summer Sessions after they have filed an application for readmission and have received their letters of approval.

New freshmen and new transfer degree students may preregister for the Summer Sessions after they have received their letter of approval. New students who desire to attend the Summer Sessions should contact the Admissions Office.

Lifelong Education (non-degree) students will preregister for the Summer Sessions by completing the Summer Sessions Registration Application in the front of the Summer Sessions Bulletin and filing this with the Summer Sessions Office by mail or in person.

REGISTRATION BY MAIL FOR ALL PREREGISTERED STUDENTS

All students (undergraduate degree, graduate degree, and Lifelong Education (non-degree) students) who have preregistered will complete registration by mail if tuition and fees have been paid by the deadlines:

First Summer Session and the Ten-Week Session—Tuesday, May 6, 1986
Second Summer Session—Tuesday, June 17, 1986

No class schedule will be mailed if tuition and fees are not paid in full by these deadlines. Class schedules will be mailed approximately one week prior to the beginning of classes to the student's mailing address. It is *very important* that all students notify the Department of Registration and Records of any address changes. Class schedules returned by the U.S. Postal Service because of an improper address should be picked up in 100 Harris Hall by Registration/Change Day:

First Summer Session and the Ten-Week Session—Monday, May 19, 1986
Second Summer Session—Monday, June 30, 1986

Degree Students should check with the Department of Registration and Records, telephone (919) 737-2572.

Lifelong Education students (non-degree) should check with the Division for Lifelong Education, McKimmon Center, telephone (919) 737-2265



If a student fails to pick up a returned class schedule, the University will assume that the student does not wish to complete registration and the student's schedule will be CANCELLED.

Remember

There are three IMPORTANT steps required for a student to complete registration:

- 1) Preregister by the deadline:
First Summer Session and Ten-Week Session—Friday, April 4, 1986
Second Summer Session—Thursday, May 15, 1986
- 2) Pay tuition and fees and *all* other debts to the University by the deadline:
First Summer Session and Ten-Week Session—Tuesday, May 6, 1986
Second Summer Session—Tuesday, June 17, 1986

NOTE: Holds placed on class schedules could be a result of parking fines, library fines, gym clothes not returned to the PE department, or other outstanding fees owed to departments that the student has not. Students are encouraged to check with the Cashiers Office (Student Accounts) if they believe that a hold on their class schedules could exist. It is the student's responsibility to clear all obligations to the University.

- 3) Obtain a class schedule and registration card. Class schedules will be *mailed* to the student's Permanent Address approximately one week prior to Registration/Change Day.

Cancellation Policy

All class schedules not mailed because of a University Hold will be automatically cancelled.

PAYMENT DEADLINES

First Summer Session and the Ten-Week Session—May 6, 1986

Second Summer Session—June 17, 1986

Adult Education Session—Fees will be collected at first class meeting.

REGISTRATION FOR NON-PREREGISTERED STUDENTS

All students will report to Reynolds Coliseum with a "Permit to Register". The "Permit to Register" may be obtained at the appropriate office according to the following categories:

Continuing Degree Students (students who were registered or withdrew during the 1986 spring semester)—Report to Room 100, Harris Hall, and request a "Permit".

Re-entering Degree Students (students who previously attended NCSU but were not enrolled during the 1986 spring semester)—Report to Room 100, Harris Hall, complete a Readmission Application and obtain a "Permit".

New Undergraduate Degree Students (never attended NCSU)—Report to the Admissions Office, 107 Peele Hall and obtain a "Permit".

New Graduate Degree Students (never attended NCSU)—Report to the Graduate Office, 104 Peele Hall and obtain a "Permit".

Lifelong Education Students (non-degree)—Report to the Division for Lifelong Education, McKimmon Center and complete a Lifelong Education Student Application Form. The application will serve as a "Permit" when properly marked by the Division for Lifelong Education.

All students will be admitted to the Coliseum from 8:30 a.m. to 12:00 noon on the Registration dates indicated below:

First Summer Session and the Ten-Week Session—May 19, 1986

Second Summer Session—June 30, 1986

WITHDRAWAL FROM THE UNIVERSITY

A regularly enrolled student who finds it necessary to drop all courses will initiate withdrawal from the University at the Counseling Center, 200 Harris Hall. A Lifelong Education student in the same circumstance initiates withdrawal from the University at the Summer Sessions Office, McKimmon Center, Gorman Street and Western Boulevard. A student who withdraws will not have any grades recorded. A student who discontinues attending classes without officially withdrawing will receive all "NC" grades.

After a short period (four days) during which it is possible to withdraw with a refund of fees (less a registration fee), there is a period during which a student may withdraw but without refund. The withdrawal deadline for undergraduates (regularly classified and Undergraduate Lifelong Education students) corresponds to the last day to drop a course at the 400-level or below; for graduate students (including Post-Baccalureate students) the deadline for withdrawal corresponds to the last day to drop 500- or 600-level courses. (See the appropriate Summer Sessions Calendar for dates.) After the published deadlines, there is no withdrawal except for unusual circumstances which can be documented as, for example, extended illness. Under these circumstances a student may petition the *Fee Appeals Committee* for a prorated refund of tuition and fees.

SPECIAL NOTES

1. Tuition and fees are payable by check or cash before or on the day of registration. Advanced billing of tuition and fees will be made *only* for those students who preregister. Payment is requested by May 6, 1986 for the first summer session and ten-week session and June 17, 1986 for the second summer session.
2. Students planning to take courses in both the first and second sessions should plan their sequences well in advance. Offerings in the second session are often substantially less in number than in the first session, and in some instances, departments do not offer courses in both summer sessions.
3. Everything possible will be done to insure that the courses listed in this bulletin will be given at the time indicated. *However, the Director of Summer Sessions reserves the right to cancel courses in which enrollment is deemed insufficient.*
4. The maximum load for either session of the Summer Sessions is two academic courses plus a PE course for undergraduates and six hours for graduates. Any student may carry less. Regularly enrolled students who desire to carry *more* than seven hours must obtain the approval of the Dean of the school in which they are enrolled. Students visiting from other schools who wish to take more than the maximum must obtain the approval of the Director of Summer Sessions.
5. *All Lifelong Education students (including those from other universities and colleges) are advised that NCSU degree students are always given priority for Summer Sessions classes. Acceptance of the Registration Application for Lifelong Education students by the Summer Sessions Office in no way constitutes a guarantee that class space will be available.*

NONDISCRIMINATION POLICY

North Carolina State University is dedicated to equality of opportunity within its community. Accordingly, North Carolina State University does not practice or condone discrimination, in any form, against students, employees, or applicants on the ground of race, color, national origin, religion, sex, age, or handicap. North Carolina State University commits itself to positive action to secure equal opportunity regardless of those characteristics.

North Carolina State University supports the protection available to members of its community under all applicable Federal laws, including Titles VI and VII of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, Sections 799A and 845 of the Public Health Service Act, the Equal Pay and Age Discrimination Acts, the Rehabilitation Act of 1973, Vietnam Veteran's Readjustment Assistance Act of 1974, and Executive Order 11246. For information concerning these provisions, contact:

Dr. Lawrence M. Clark
Associate Provost and University Affirmative Action Officer
Box 7101
North Carolina State University
Raleigh, North Carolina 27695-7101
Phone: (919) 737-3148

PLANNING TO GRADUATE. . . .

If you plan to graduate at the end of the summer sessions, there are a number of items that should be of interest to you.

1. You should submit an Application for Degree card for *each* degree you are to receive. This should be turned in to your department within two weeks after the beginning of the session. If for any reason you submitted an Application for Degree card last semester, but did not graduate, it is necessary that you submit *another Application* for the summer sessions. Remember: If you are to receive two degrees, you must submit a separate application for each degree.
2. Your local address and your official University correspondence address should be kept up-to-date. Also, the address you show on your Application for Degree card will be the address to which your diploma is mailed and also the address to which any further correspondence from this university will be sent. Any changes should be made by reporting the new address to the Department of Registration and Records, 100 Harris Hall, Box 7313, Raleigh, NC 27695-7313.
3. If you are transferring hours from another university in order to graduate, this should be done before the end of the summer sessions. If you are enrolled at another institution and that institution is unable to furnish an official transcript by the end of this session, you must have that university's Registrar send to the Department of Registration and Records a letter showing the course and grade with an official school seal and Registrar's signature. This letter must be received by the end of the summer session.
4. Correspondence course grades must be received, all incompletes and late grades cleared, and all fines and fees paid by the end of the summer session.
5. If you are eligible to take reexamination, it must be taken no later than 30 days after the date of the intended graduation.
6. If you would like to participate in the May, 1987 commencement exercises, contact your school Dean's office at your earliest convenience. You will be placed on a mailing list to receive all necessary information about the graduation activities. Graduation exercises are scheduled for May 9, 1987.

If you have any questions concerning the above information, please call Arlene Richardson, Supervisor of Records, Department of Registration and Records, 100 Harris Hall, telephone (919) 737-2572.

ACADEMIC REGULATIONS

North Carolina State University's grading system for recording academic achievement is:

DEFINITION OF LETTER GRADES AND GRADE POINTS

<i>Grade</i>	<i>Definition</i>	<i>Grade Points Per Credit Hour</i>
A	Excellent	4
B	Good	3
C	Satisfactory ("Passing" for graduate students)	2
D	Marginal	1
NC	No Credit	0

(The following grades are not used in the calculation of grade point averages.)

S	Satisfactory (Credit-only and certain other courses)
U	Unsatisfactory (Credit-only and certain other courses)
CR	Credit by Examination or Advanced Placement
IN	Incomplete
LA	Temporarily Late
AU	Audit
NR	No Recognition Given for Audit

Questions concerning this grading system should be directed to James H. Bundy, University Registrar, NCSU, Box 7313, Raleigh, N.C. 27695-7313.

EXPENSES

TUITION AND FEES RATE SCHEDULE—1986 SUMMER SESSIONS

Undergraduates

Residents of North Carolina				Nonresidents			
<i>Hours</i>	<i>Tuition</i>	<i>Required Fees</i>	<i>Total</i>	<i>Hours</i>	<i>Tuition</i>	<i>Required Fees</i>	<i>Total</i>
0-5	\$ 60	\$53	\$113	0-5	\$ 425	\$53	\$ 478
6-8	120	53	173	6-8	850	53	903
9-11	180	53	233	9-11	1,275	53	1,328
12+	240	53	293	12+	1,700	53	1,753

Graduate Students

Residents of North Carolina				Nonresidents			
<i>Hours</i>	<i>Tuition</i>	<i>Required Fees</i>	<i>Total</i>	<i>Hours</i>	<i>Tuition</i>	<i>Required Fees</i>	<i>Total</i>
0-Thesis	\$110	\$ 6	\$116	0-Thesis	\$ 303	\$ 6	\$ 309
0-2	60	53	113	0-2	425	53	478
3-5	120	53	173	3-5	850	53	903
6-8	180	53	233	6-8	1,275	53	1,328
9+	240	53	293	9+	1,700	53	1,753

School of Veterinary Medicine

Residents of North Carolina

Nonresidents

<i>Hours</i>	<i>Tuition</i>	<i>Required Fees</i>	<i>Total</i>	<i>Hours</i>	<i>Tuition</i>	<i>Required Fees</i>	<i>Total</i>
0-2	\$134	\$53	\$187	0-2	\$ 525	\$53	\$ 578
3-5	268	53	321	3-5	1,049	53	1,102
6-8	401	53	454	6-8	1,574	53	1,627
9+	535	53	588	9+	2,098	53	2,151



SPECIAL REGISTRATION AND FEES

A. Thesis Preparation (GR 598 or GR 698), Dissertation Research (GR 697), Examination Only (GR 597), and Summer Research (GR 596S or GR 696S) are all charged the 0-Thesis rate.

B. Cooperative Education Fee \$115

C. Audits Rates same as for credit

Note: The tuition and fees charge is assessed according to the total hours and courses carried as of 5:00 p.m. on:

—Monday, May 26, 1986, for the first summer session and ten-week session.

—Monday, July 7, 1986 for the second summer session.

* Tuition and fees for the 1986 summer sessions are tentative rates and are subject to change.

NOTICES

1. A statement of tuition and fees is mailed to each preregistered student around 20-30 days before the beginning of each summer session. The statement must be returned with full payment or complete financial assistance information by May 6, 1986 for the first summer session and the ten-week session and by June 17, 1986 for the second summer session. Nonpreregistered students are required to pay tuition and fees at registration. Deferred payments will not be allowed during the summer sessions.
2. Required fees are included in the rates listed above and must be paid by all students. Students are entitled to the services, facilities, and programs offered by the Student Center, Health Services, Physical Education Department, and Athletics Department. An itemization of required fees will be provided upon request.
3. Upon adding course work that results in an increased fee, students should pay at the Coliseum on Registration Day and at 2 Peele Hall thereafter. Refunds resulting from courses dropped can be obtained by presenting the official drop form at 2 Peele Hall.
4. All students enrolled in courses designated as requiring student use of University, School, or Departmental computing resources during class or laboratory sessions or as homework assignments will be charged a computer course fee of \$15 per summer session. Similarly, all students enrolled in courses designated as requiring student use of University, School, or Departmental laboratory resources will be charged a laboratory course fee of \$15 per summer session. The maximum course fee to be charged to any student will be \$30 per summer session regardless of the computer and/or laboratory courses taken. This fee will *not* be waived when a designated lab or computer fee course is dropped *after the official enrollment date*. (Official enrollment dates are stated at the end of the following listing of designated courses.)

COURSES REQUIRING COMPUTER OR LABORATORY COURSE FEES SUMMER SESSIONS, 1986

ACC	360	CSC	200X	FLS	102	PD	400
		CSC	200Y	FLS	102E		
ANS(PO)	204	CSC	201E	FLS	201	PO(ANS)	204
ANS	410	CSC	252E	FLS	201E		
		CSC	311E			PP	503
ARC	400	CSC	417	FOR	111		
		CSC	499	FOR	204	PS	371
BAE	590B			FOR	261		
		CSE	452	FOR	264	PY	205
BCH	554	CSE	453	FOR	274	PY	208
		CSE	457	FOR(FW)	310	PY	211
BO	200	CSE	458	FOR	591	PY	212
BO(ZO)	360	CSE	699	FOR	691	PY	231
BO	421			FOR	699		
		DN	251			SOC	416
BS	100	DN	253	FW(FOR)	310		
BS	510	DN	254			ST	512S
				HS	101	ST	516
CE	326	EB	415	HS	371		
CE	382					T	105
		ECE	213	IA	115	T	220
CH	101	ECE	214	IA	122	T	250
CH	103	ECE	301	IA	351	T	301
CH	104	ECE	302	IA	590		
CH	107					TX	621
CH	221	ENT(ZO)	425	IE	361		
CH	223			IE	401	VD	400
CH	315	FLF	101				
CH	499	FLF	101E	LAR	698	WPS	205
		FLF	102			WPS	491
CHE	205	FLF	102E	MAE	305		
CHE	225	FLF	201	MAE	306	ZO	201
CHE	497			MAE	435	ZO	212
		FLG	101			ZO	303
CSC	101E	FLG	102	MAT	200	ZO(BO)	360
CSC	102E	FLS	101			ZO(ENT)	425
CSC	111	FLS	101E	MEA	110		

****Course fees will be assessed for courses officially carried at 5:00 p.m. on Monday, May 26 for the First and Ten-Week Sessions; Monday, July 7 for the Second Session.****

RESIDENCE STATUS CLASSIFICATION FOR TUITION PURPOSES

To qualify as a resident for tuition purposes, a person must have established legal residence (domicile) in North Carolina and maintained that legal residence for at least twelve months immediately prior to his or her classification as a resident for tuition purposes. To be eligible for classification as a resident for

tuition purposes a person must establish that his or her presence in the State is, and during the requisite twelve month qualifying period was, for purposes of maintaining a bona fide domicile rather than of maintaining a mere temporary residence or abode incident to enrollment in an institution of higher education.

North Carolina General Statute (G. S.) 116-143.1 is the governing law concerning resident status classification and sets forth statutory definitions, rules and special provisions for determining resident status for tuition purposes. Copies of the law and implementing regulations are found in *A Manual to Assist the Public Higher Education Institutions of North Carolina in the Matter of Student Residence Classification for Tuition Purposes* which is available for inspection in the Office of Undergraduate Admissions, 112 Peele Hall. Special situations concerning minors, the military, and marriage as they relate to residence status classification are addressed in *The Manual*. It is the student's responsibility to initiate a review of their situation when classification or re-classification as a resident for tuition purposes is sought.

Active military personnel assigned to North Carolina and their military dependents may be eligible to receive the benefit of the in-state tuition rate under G.S. 116-143.3. A student who qualifies for the in-state tuition rate under this statute is not considered a resident, but merely eligible for the benefit of the in-state tuition rate. Application for eligibility to be charged the in-state tuition rate under G.S. 116-143.3 must be made prior to initial enrollment or re-enrollment for which the student claims the benefit. Further application for such eligibility must similarly be made prior to the outset of each successive academic year of enrollment.

Questions concerning residence status classification should be addressed to the Director of Undergraduate Admissions, North Carolina State University, Box 7103, Raleigh, North Carolina 27695-7103.

REFUND OF TUITION AND FEES

A student who withdraws from school on or before the fourth day of classes of either summer session will receive a refund of the full amount paid, less a \$15 registration fee. (Students enrolled in 10-week courses who withdraw before the fourth scheduled class meeting will also receive a full refund less the \$15 registration fee.) After the period specified, no refunds will be made.

In some instances, circumstances justify waiving rules regarding refunds. An example might be withdrawal from the University because of illness. Students have the privilege of appeal to the Fee Appeals Committee when they feel special consideration is merited. Application for such appeals may be secured from the Department of Registration and Records (100 Harris Hall) or University Cashier and Student Accounts Office (2 Peele Hall).

FINANCIAL AID

The financial aid available to regular students attending the Summer Sessions is ordinarily limited to loans and work-study jobs. Students who wish to be considered for financial aid should make application to the Financial Aid Office, Peele Hall, as far in advance as possible, preferably no later than April 1, 1986. Summer applications will be available in early March.

The University has no financial aid for summer visitor students. However, these students may have access to the part-time job listings on the bulletin board outside the Financial Aid Office, 2nd Floor, Peele Hall.



COUNSELING

The Counseling Center provides services designed to assist individuals in gaining a better understanding of themselves and their opportunities. Professional counselors are available to work with students who desire assistance with concerns such as: choosing a career; planning an academic program leading to a career; identifying and overcoming educational difficulties; developing greater self-understanding; and developing more satisfying personal relationships. All counseling is strictly confidential.

In addition to individual counseling, workshops are offered throughout the year in a variety of areas, including vocational exploration, study skills, and anxiety-reduction.

Counseling services are available without cost to NCSU students. Appointments may be scheduled over the telephone (737-2423) or in person by coming to 200 Harris Hall.

HOUSING

RESIDENCE HALLS

During the 1986 summer sessions, housing will be provided in the residence halls on a first-come, first-served basis for men and women who are enrolled for one or more courses.

Assignment to a room for a summer session does not guarantee that a room will be available for the fall semester. A student must be accepted by NCSU for fall enrollment as a full-time student to be eligible to apply for University housing.

ROOM RENTALS AND APPLICATIONS

The rental rate for a five-week session is \$140.00 per person in a double room. *If space is available*, a single room may be reserved for \$200.00 each session. To obtain an assignment, the student must complete the housing request card and return it with a check to the University Cashier and Student Accounts Office, NCSU, Box 7213, Raleigh, N.C. 27695-7213. The room assignment will be mailed if time permits, or may be picked up at the Housing Assignments Office in Harris Hall on the day the residence halls open for the session.

Residents will be permitted to change rooms after the first week of classes with the approval of the Housing Assignments Office. The room change fee is \$5.00. *Opening days of the residence halls will be as follows:*

FIRST SESSION—10:00 a.m., Sunday, May 18, 1986

SECOND SESSION— 10:00 a.m., Sunday, June 29, 1986

HOUSING REFUND POLICY

Cancellation of a room reservation must be made in writing as follows:

- (a) In person at the Housing Assignments Office in Harris Hall, Monday through Friday, between 8 a.m. and 5 p.m., on the cancellation form provided; or
- (b) By mail addressed to the Housing Assignments Office, Box 7315, NCSU, Raleigh, N.C., 27695-7315.

The effective date of cancellation is the date notification is received at the Housing Assignments Office or the date the room is vacated, whichever is later. Residents who have moved out of their rooms must return their Check-Out Card to the Housing Assignments Office when applying for a room rent refund.

If the housing agreement is cancelled on or before Registration Day, the rental fee paid will be refunded less a \$25 processing fee. *If the housing agreement is cancelled AFTER 5 p.m. on Registration Day, NO REFUND of room rent will be made.* In cases of medical withdrawals, however, a \$25 processing fee will be charged plus \$3.00 a day from date of occupancy.

If a student fails to check in and secure his/her keys by 5 p.m. on Registration Day, the housing agreement will be cancelled and NO REFUND will be made except as stated above.

STUDENT FAMILY HOUSING

The University operates E.S. King Village as an apartment complex for students with families. This complex consists of 300 apartments (120 efficiency, 148 one-bedroom, and 32 two-bedroom). Interested students should write to Student Family Housing, NCSU, Box 7315, Raleigh, N.C., 27695-7315, for family housing applications and information.

FRATERNITY HOUSES

Several of the 20 fraternity houses located on or adjacent to the campus provide housing for summer sessions students. Twelve of the 20 houses are fully air conditioned and all provide furnished rooms and living areas. In addition, some houses offer board plans during the summer months. Any student interested in further details should write to the Office of Student Development, Box 7314, NCSU, Raleigh, N.C., 27695-7314 or telephone (919) 737-2441.

D. H. HILL LIBRARY

The libraries of North Carolina State University contain more than 1,200,000 volumes of books and bound journals, 620,000 federal government publications, and 2,500,000 microforms. The collection is especially strong in the physical and biological sciences, agriculture, textiles, architecture and design. The D. H. Hill Library houses the vast majority of these publications and subscribes to over 9,400 periodicals. Five branch libraries—the School of Textiles Library in Nelson Hall, the Design School Library in Brooks Hall, the School of Forest Resources Library in Biltmore Hall, Veterinary Medical Library in the School of Veterinary Medicine, and the Curriculum Materials Center in Poe Hall—serve the special needs of their schools.

The D. H. Hill Library has been a depository for U. S. government publications since 1924 and receives over 97% of these publications. The library also receives the microfiche research reports published by the Department of Energy (DOE), the National Aeronautical and Space Administration (NASA), the Educational Resources Information Center (ERIC), and the National Technical Information Service (NTIS).

On-line computer-based literature searching is offered by the library from a number of data bases such as ERIC, AGRICOLA (Bibliography of Agriculture), Psychological Abstracts, Sociological Abstracts, BIOSIS (Biological Abstracts), and Nuclear Science Abstracts. Only direct costs are charged to the user.

Facilities and equipment are also available for both individual and group use of audiovisual media. The library's theater can be scheduled for group media presentations, and films in the State Library's film collection can be borrowed by the D. H. Hill Library's Media Center for academic use by faculty and students.



The scholar, student, and browser will each discover the materials and services of the library to be useful and enjoyable additions to his or her summer sessions program. All areas of the library complex are air-conditioned and open to students and faculty.

Library hours for the Summer Sessions are as follows:

Monday-Thursday	7:45 a.m.-12:00 midnight
Friday	7:45 a.m.- 9:30 p.m.
Saturday	9:30 a.m.- 6:00 p.m.
Sunday	1:00 p.m.-12:00 midnight

SUMMER ACTIVITIES

Through many curricular and extracurricular activities, the Summer Sessions provide special opportunities to those students engaged in summer study. Interesting, informative and entertaining programs and activities are scheduled for each session.

A few of the more popular activities and special features include the Carmichael Gym athletic and recreation programs and the varied activities sponsored by the University Student Center.

The University's regular program of student personnel services is available to summer students. It includes the Counseling Center for educational, career and personal counseling; the Career Planning and Placement Center for career planning and placement; the Residence Life and Residence Facilities offices for residence quarters; the Financial Aid Office for financial assistance; and the Student Health Service for medical care.

Beyond the campus, the city of Raleigh offers cultural and recreational opportunities of interest to students. The Raleigh Little Theater presents several productions during the summer, the North Carolina Museum of Art sponsors gallery concerts and exhibits, and there are several swimming pools and city and state parks located in and around Raleigh.

UNIVERSITY STUDENT CENTER

The hub of campus summer activity is the University Student Center. The Center is supported in part by student fees, and all Summer Sessions students are invited to attend the programs and activities sponsored by the Summer Programs Board. These programs include movies and a variety of social and recreational events.

The air-conditioned Center offers many facilities, including a television lounge, an art gallery, offices for student organizations, a game room, snack bar, theater and meeting rooms. The Craft Center in the Thompson Building has a full range of crafts programs.

University Student Center hours during the summer are:

Monday-Friday	7:30 a.m.-11:00 p.m.
Saturday-Sunday	9:00 a.m.-11:00 p.m.

SPECIAL COURSES AND INSTITUTES

Department of Adult and Community College Education

REGIONAL SUMMER SCHOOL FOR ADULT, EXTENSION, AND COMMUNITY COLLEGE EDUCATORS

June 16-July 3

The Department of Adult and Community College Education offers a special three-week program of instruction designed to provide graduate study and professional improvement opportunities for educators. This intensive session assists extension workers, community college instructors, administrators, and other adults to increase their understanding of topics such as current issues in community colleges, use of microcomputers, designing and producing educational materials, and coping with decline. It also offers opportunities for keeping up-to-date in areas of agricultural and home economics technology.

The program is interdisciplinary; it enlists the professional competence of visiting and resident faculty. Courses meet daily in blocks scheduled for morning and afternoon. Each participant may take a maximum of six semester hours. Course offerings are listed below.

Students enrolling for the special three-week session will complete registration during the first class session. To assist the Department of Adult and Community College Education in planning, students are requested to complete and return an application form for the 1986 Regional Summer School by May 1, 1986. The form may be obtained from Dr. Edgar J. Boone, Department of Adult & Community College Education, NCSU, Box 7607, Raleigh, N.C. 27695-7607.

ANS 590A	Advanced Animal Reproduction
BAE 590B	Total Water Management Systems for Agricultural Production
EB 415	Farm Appraisal and Finance
ED 503	The Programming Process in Adult and Community College Education
ED 537	The Extension and Public Service Function in Higher Education
ED 579	Concepts and Principles of Evaluation Applied to Non-formal Adult Education Programs
ED 596A	The Modern Practice of Adult Education
ED 596B	Instructional Leadership in the Community College
ED 596C	Microcomputer Applications in Adult and Extension Education
ED 601	Administrative Concepts and Theories Applied to Adult and Community College Education
HS 595A	Production, Maintenance and Marketing of Quality Horticultural Crops

NCSU MIDDLE SCHOOL WORKSHOP—"ALTERNATIVES FOR THE MIDDLE YEARS"

(Listed as ED 598A)

June 16-June 27

The Seventh Annual activity-oriented workshop is designed to help teachers and administrators develop humane and imaginative programs for students ages 10-15. It will focus upon (a) The developmental needs, interests and abilities of emerging adolescents; (b) Curriculum ideas and teaching methods; and (c) School organization strategies.

Participants will be involved in whole group activities and mini-courses which explore topics such as:

- Adolescence and contemporary society
- Learning styles
- Interdisciplinary inquiry
- Arts and the adolescent
- Learning environment/classroom design
- Creativity and the right side of the brain
- Competition and cooperation
- Case studies of outstanding schools
- Strategies for change
- Outdoor education
- Early adolescent sexuality
- Moral development & values clarification
- Adolescence and authority
- Cognitive and social development in adolescence
- All school activities
- Learning games and simulations
- The principal as educational leader

In addition, special electives will be offered in math, science, language arts and social studies.

Emphasis in most sessions will be placed upon activity, involvement and sharing. Films, slides, simulations, small group discussions, working with classroom materials, and a variety of other learning techniques will be utilized.

The workshop will be directed by John Arnold, Coordinator of Middle Years Education at NCSU, and Chris Stevenson, University of Vermont. Consultants from the State Department of Public Instruction and from area schools will serve on a part-time basis.

Sessions will meet Monday through Friday from 9:00 a.m. to 3:30 p.m. Three graduate credits will be granted to those who participate satisfactorily and complete a curriculum project. Also, 5.5 CEU credits will be awarded by the State Department of Public Instruction.

Dormitory rooms ranging from \$8-15 per night per person, double occupancy, will be available for out-of-town participants. Rooms may be reserved by contacting the Housing Assignments Office, NCSU, Box 7315, Raleigh, N.C. 27695-7315.

To register, contact Dr. John Arnold, Department of Curriculum and Instruction, NCSU, Box 7801, Raleigh, N.C. 27695-7801, for special registration forms. Or, you may call 737-3221 and request forms from the secretary.

WORKSHOPS IN NEW TECHNOLOGY FOR SCIENCE TEACHERS

Two workshops will be offered to assist Science Teachers in gaining the knowledge and confidence needed to incorporate microcomputers into classroom and laboratory instruction:

- ED 594A Special Problems in Science Teaching—Workshop in New Technology (Middle Schools)
July 7-18
- ED 594B Special Problems in Science Teaching—Workshop in New Technology (High Schools)
July 21-August 1

Application forms are available from the Department of Mathematics and Science Education, NCSU, Box 7801, Raleigh, N.C. 27695-7801, (Phone: 919/737-2239).

INSTITUTE FOR TEACHERS OF GIFTED AND TALENTED **July 1-July 23**

This institute will consist of two courses:

ED 598Y Special Problems in Curriculum and Instruction: Creativity
&

ED 598J Special Problems in Curriculum and Instruction: Appropriate Services for Gifted Students

Registration for this 3½-week workshop must be completed during the regularly scheduled Preregistration and Registration times for the University's Second Summer Session. For further information, contact: Dr. Lyn Aubrecht, Department of Curriculum and Instruction, NCSU, Box 7801, Raleigh, N.C. 27695-7801, (Phone: 919/737-3221).

INSTITUTE FOR TEACHING VISUALLY IMPAIRED **June 9-June 25**

In order to serve the needs of the public school system and other appropriate agencies concerned with services for the visually-impaired, two courses are being offered in a shortened session:

ED 513 Introduction to Issues and Techniques in Visual Impairments
&

ED 523 Orientation and Mobility of the Visually Impaired

Dormitory rooms ranging from \$8-15 per night, per person, double occupancy, will be available for out-of-town participants. Rooms may be reserved by contacting the Housing Assignments Office, NCSU, Box 7315, Raleigh, N. C. 27695-7315.

Registration for this 2½-week workshop must be completed during the regularly scheduled Preregistration and Registration times set for the University's First Summer Session. For further information, contact: Dr. Harold Griffin, Department of Curriculum and Instruction, NCSU, Box 7801, Raleigh, N. C. 27695-7801, (Phone: 919/737-3221).

TEACHING OF WRITING INSTITUTE **(ED 598D)** **June 23-July 21**

The Capital Area Writing Project (CAWP) at N. C. State University is modeled after the highly successful National Writing Project and is one of eight sites of the North Carolina Writing Project network.

Experienced elementary and secondary teachers of English and other content areas are eligible for the 25 Fellowships available. Applicants should have a marked interest in improving effectiveness in teaching writing and in sharing new knowledge with their colleagues. Participants will agree to conduct in-service programs as Teacher/Consultants within the Region. Applicants from private schools and colleges within Region Three can be considered only if public school applicants do not fill available openings.

Fellows will receive (at no cost) six hours of graduate credit from NCSU in the teaching of writing, a \$400 stipend, and a text of numerous writing activities and successful teaching strategies developed during the four weeks of the Project.

Workshop sessions will be held five days per week, Monday through Friday. Mornings will be spent in journal writing, group response and editing. Because of the intensive nature of the workshop and occasional evening activities, dormitory residence during the week is recommended, though not required. Participants will be expected to attend an all-day orientation on Saturday, June 7.

For further information about the Capital Area Writing Project at NCSU, please contact either Ruie Pritchard (NCSU) at 919/737-3221 or Sally Buckner (Peace College) at 919/832-2881.

EVENING SUMMER SESSIONS AND UNDERGRADUATE DEGREE PROGRAMS

Late afternoon and evening classes are scheduled during the First Session (May 19-June 25), Second Session (June 30-August 7), and the Ten-Week Session (May 19-August 4) for the convenience of Evening Degree students, Lifelong Education students and "traditional" day students who have summer jobs but who would like to remain academically active. Many of the evening courses offered in the 1986 Summer Sessions may be used toward fulfilling the basic requirements for a B.A. degree from the School of Humanities and Social Sciences.

The following departments are offering late afternoon and evening classes during the 1986 Summer Sessions: Accounting, Adult and Community College Education, Anthropology, Computer Science, Computer Studies, Counselor Education, Curriculum and Instruction, Economics and Business, English, French, Health Occupations, Industrial Arts, Mathematics, Mathematics and Science Education, Physical Education, Political Science, Public Administration, Sociology, Spanish and Zoology. Please refer to the Course Listings beginning on page 34 for specific details.

For information concerning the evening degree and certificate programs in the School of Humanities and Social Sciences, contact Ms. Lynda Hambourger, Coordinator of Evening Programs, Room 106 Link Building, or call (919) 737-2467. Ms. Hambourger's office is open until 7:30 p.m. Monday through Thursday and until 5:00 p.m. Fridays.

SUMMER INSTITUTE IN ENGLISH FOR SPEAKERS OF OTHER LANGUAGES

June 30-August 9

The Summer Institute in English for Speakers of Other Languages at North Carolina State University is designed for those students from other countries who intend to pursue university studies or specialized training programs in the United States in fall. It is designed to furnish them with intensive instruction and practice in the use of the English language. Emphasis is placed on developing fluency in speaking and understanding oral English as well as reading and writing skills. The Institute also offers orientation to American life and institutions to give the students insight into life in the U. S. and help them to adjust to the new environment. There are field trips on weekends to places of historic, cultural and scenic interest.

Any student who has a score of 400 on the TOEFL (Test of English as a Foreign Language) or an equivalent facility in the use of spoken English may attend the

Institute. (Information about taking the test at one of the centers located in the students' home countries may be obtained by writing to: Test of English as a Foreign Language, Educational Testing Service, Princeton, New Jersey.)

Admission to the Institute does not imply admission as a degree candidate at North Carolina State University or any other campus of The University of North Carolina.

The Institute, which is sponsored by the Division for Lifelong Education in cooperation with the Summer Sessions and the Department of Foreign Languages and Literatures, is under the direction of Miss Virginia Prichard of the Department of Foreign Languages and Literatures. All classroom work is conducted on the campus. Classes, including language laboratory practice sessions, are held five and a half hours a day, Monday through Friday, from 8:00 to 12:30 and 1:30 to 2:30. (Attendance at the Institute does not carry academic credit, although students who complete the program receive a certificate of attendance.)

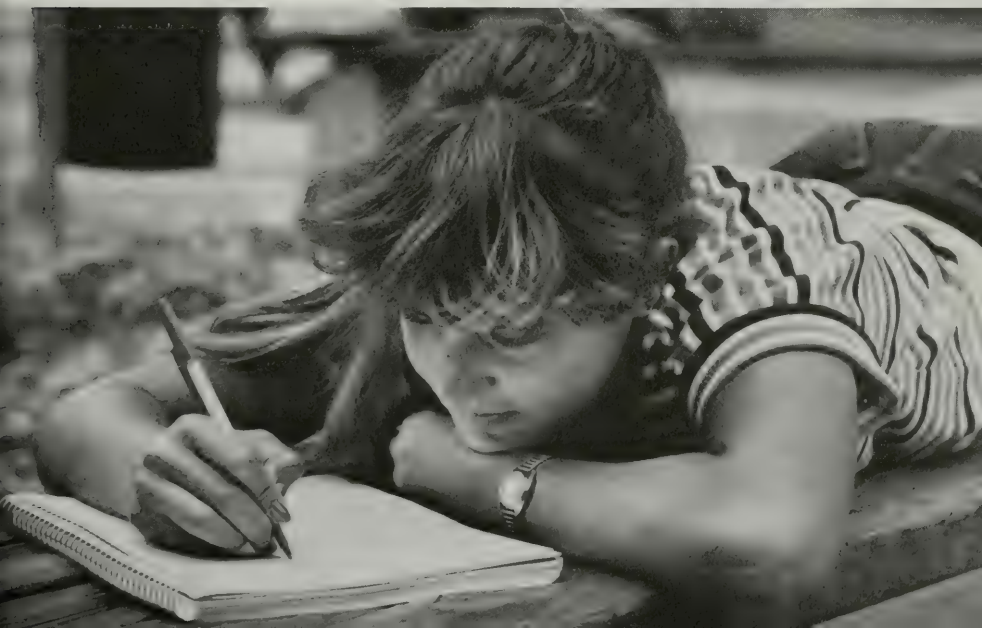
The total cost of the six-week program is approximately \$1,650. The cost of the Institute is estimated on the basis of campus dormitory accommodations and meals at the campus cafeterias. Incidental expenses, such as laundry, dry cleaning, entertainment, etc., are not included. (Room rent includes sheets and towels.)

Course and Books/Materials Fees	\$600.00
Room in Campus Dormitory (Estimated)	\$600.00
Food (Estimated)	\$420.00

For further information about the Institute, write to Nancy E. Polk, Program Coordinator, Division for Lifelong Education, NCSU, Box 7401, Raleigh, North Carolina 27695-7401.

INDEPENDENT STUDY BY EXTENSION

In addition to the classes listed in this schedule, many undergraduate courses are available through independent study (correspondence instruction). This program allows students to enroll at any time, to work at their own pace, and to take up to thirteen months to complete a course. For further information about independent study, including a complete listing of courses, contact Independent Study by Extension, 201 Abernethy Hall 002A, University of North Carolina, Chapel Hill, North Carolina 27514, Telephone (919) 962-1106.





COURSE LISTINGS

Courses are listed by department, departmental abbreviation and numerical designator. Semester hour credits for each course are given following the name of the course. Classes meet daily, Monday through Friday, except where specified to the contrary. The symbols "LR" "LB" and "PR" before the clock hours refer to "lecture-recitation," "laboratory" and "problem-solving session," respectively. If there is no symbol before the clock hours, lecture-recitation is implied.

The number in parentheses to the right of the class meeting time is the "Call Number". This number must be indicated on the preregistration schedule request form by students who are preregistering for summer sessions courses.

The "\$" symbol beside the departmental abbreviation and course number indicates that the course has been designated as requiring student use of University, School or Departmental laboratory or computing resources. Students enrolling in each course so designated will be charged a \$15.00 laboratory/computer course fee.

Courses numbered from one through 99 are preparatory courses carrying no college credit; courses in the 100, 200, 300 and 400 series are primarily designed for undergraduates; courses in the 500 series for graduates and advanced undergraduates; and courses in the 600 series for graduates only. Consent of the department is required to register for all practicum and individual special topics or special problems courses as well as internships and thesis or dissertation research.

All courses are subject to cancellation by the Director of Summer Sessions if there is inadequate enrollment.

Waiver of prerequisites is at the discretion of the instructor.
Please note that class meeting times in this bulletin are indicated in international time which is measured in hours numbered to 24 instead of 12.



If the schedule shows the class beginning at:	The beginning hour in terms of a 12-hour clock is:	If the schedule shows the class beginning at:	The beginning hour in terms of a 12-hour clock is:
0800	8:00 a.m.	1600	4:00 p.m.
0900	9:00 a.m.	1700	5:00 p.m.
1000	10:00 a.m.	1800	6:00 p.m.
1100	11:00 a.m.	1900	7:00 p.m.
1200	12:00 noon	2000	8:00 p.m.
1300	1:00 p.m.	2100	9:00 p.m.
1400	2:00 p.m.	2200	10:00 p.m.
1500	3:00 p.m.		

SPECIAL GRADUATE CATEGORIES

FIRST SESSION AND SECOND SESSION

GR 596S	MR Summer Research	(46-596-001) 0
GR 597	Master's Exam Only	(46-597-001) 0
GR 598	MR Thesis Preparation	(46-598-001) 0
GR 696S	DR Summer Research	(46-696-001) 0
GR 697	Dissertation Research	(46-697-001) 0
GR 698	DR Thesis Preparation	(46-698-001) 0

Accounting

FIRST SESSION

ACC 260 Accounting I—Concepts of Financial Reporting	3
0800-0930 (04-260-001)	Rockness
0950-1120 (04-260-002)	Zuckerman
1140-1310 (04-260-003)	Staff
1340-1510 (04-260-004)	Zuckerman

ACC 261 Accounting II—An Introduction to Managerial Accounting	3
Prerequisite: ACC 260	
0800-0930 (04-261-001)	Staff

ACC 262 Managerial Uses of Cost Data	3
Prerequisite: ACC 261	
0950-1120 (04-262-001)	Skender

\$ ACC 360 Intermediate Financial Accounting I	3
Prerequisite: ACC 261	
0800-0930 (04-360-001)	Brooks
0950-1120 (04-360-002)	Brooks

ACC 364 An Introduction to Income Taxation	3
Prerequisites: ACC 260 and EB 201	
0800-0930 (04-364-001)	Peace

ACC 466 Auditing Financial Information	3
Prerequisites: ACC 361 and EB (ST) 350	
0800-0930 (04-466-001)	Skender

SECOND SESSION

ACC 260 Accounting I—Concepts of Financial Reporting	3
1340-1510 (04-260-001)	Ferreri
0800-0930 (04-260-002)	Staff

ACC 261 Accounting II—An Introduction to Managerial Accounting	3
Prerequisite: ACC 260	
0950-1120 (04-261-001)	Williams
1140-1310 (04-261-002)	Williams

ACC 361 Intermediate Financial Accounting II	3
Prerequisite: ACC 360	
1140-1310 (04-361-001)	Bublitz
0950-1120 (04-361-002)	Staff

ACC 362 Production Cost Analysis and Control	3
Prerequisites: ACC 262 and EB 350	
0950-1120 (04-362-001)	Ferreri

ACC 401 Advanced Financial Accounting	3
Prerequisites: ACC 361	
1340-1510 (04-401-001)	Bublitz

TEN-WEEK SESSION

ACC 260E Accounting I—Concepts of Financial Reporting	3
1945-2130 TuTh (04-260-051)	Carraway

Animal Science

FIRST SESSION

ANS 590 Topical Problems in Animal Science	Maximum 6
Hours arranged (10-590-001)	Lassiter

ANS 699 Research in Animal Science	Credits Arranged
Hours arranged (10-699-001)	Lassiter

SECOND SESSION

\$ ANS (PO) 204 Feeds and Feeding	4
LR 0800-0930 (10-204-001)	Pond
LB 1340-1620 TuTh (10-204-101)	

\$ ANS 410 Horse Science	3
Prerequisite: ANS 310 or Consent of Instructor	
LR 1020-1120 (10-410-001)	Cornwell
LB 1340-1620 MW (10-410-101)	

ANS 590 Topical Problems in Animal Science	Maximum 6
Hours arranged (10-590-001)	Lassiter

ANS 699 Research in Animal Science	Credits Arranged
Hours arranged (10-699-001)	Lassiter

ADULT EDUCATION SESSION (See page 27)

ANS 590A Topical Problems in Animal Science: Advanced Animal Reproduction	3
0900-1230	Britt

Anthropology

FIRST SESSION

ANT 251 Physical Anthropology	3
0800-0930 (12-251-001)	Rovner

ANT 252 Cultural Anthropology	3
0800-0930 (12-252-001)	Wallace
0950-1120 (12-252-002)	Ellovich

ANT 252E Cultural Anthropology	3
1745-1930 MTuWTh (12-252-003)	Ellovich

ANT 253 Prehistoric Archaeology	3
0950-1120 (12-253-001)	Rovner

ANT 254 Language and Culture	3
0950-1120 (12-254-001)	Wallace

ANT 498 Special Topics in Anthropology	1-6
Prerequisite: Six hours of SOC/ANT	
Hours arranged (12-498-001)	Walek

ANT 591 Special Topics in Anthropology	1-6
Prerequisite: ANT 501 or equivalent	
Hours arranged (12-591-001)	Moxley
SECOND SESSION	
ANT 251 Physical Anthropology	3
0800-0930 (12-251-001)	Staff
ANT 252 Cultural Anthropology	3
0800-0930 (12-252-001)	Nickerson
0950-1120 (12-252-002)	Nickerson
ANT 252E Cultural Anthropology	3
1745-1930 MTuWTh (12-252-003)	Staff
ANT 498 Special Topics in Anthropology	1-6
Prerequisite: Six hours of SOC/ANT	
Hours arranged (12-498-001)	Walek
ANT 591 Special Topics in Anthropology	1-6
Prerequisite: ANT 501 or equivalent	
Hours arranged (12-591-001)	Moxley

Architecture

FIRST SESSION

ARC 595 Independent Study	1-3
Prerequisite: Graduate standing	
Hours arranged (13-595-001)	Burns
ARC 691 Special Topics in Architecture	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (13-691-001)	Burns

SECOND SESSION

ARC 595 Independent Study	1-3
Prerequisite: Graduate standing	
Hours arranged (13-595-001)	Burns
ARC 692 Special Topics in Architecture	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (13-692-001)	Burns

TEN-WEEK SESSION

\$ ARC 400 Intermediate Architectural Design	6
Prerequisite: DF 102. May not be taken more than six times.	
1340-1750 MTuWTh (13-400-051)	Place
May 19-July 11—Eight Week Course—Final Exam July 14	

Biological and Agricultural Engineering

FIRST SESSION

BAE 590 Special Problems	Credits Arranged
Prerequisite: Senior or Graduate standing in Biological and Agricultural Engineering	
Hours arranged (16-590-001)	Staff
BAE 690 Special Topics	1-4
Prerequisite: Graduate standing	
Hours arranged (16-690-001)	Staff

BAE 699 Research in Biological and Agricultural Engineering Credits Arranged
 Prerequisite: Graduate standing in Biological and Agricultural Engineering
 Hours arranged (16-699-001) Staff

SECOND SESSION

BAE 590 Special Problems Credits Arranged
 Prerequisite: Senior or Graduate standing in Biological and Agricultural Engineering
 Hours arranged (16-590-001) Staff

BAE 690 Special Topics 1-4
 Prerequisite: Graduate standing
 Hours arranged (16-690-001) Staff

BAE 699 Research in Biological and Agricultural Engineering Credits Arranged
 Prerequisite: Graduate standing in Biological and Agricultural Engineering
 Hours arranged (16-699-001) Staff

ADULT EDUCATION SESSION (See page 27)

\$ BAE 590B Special Problems: Total Water Management Systems 3
for Agricultural Production
 Prerequisite: Consent of Instructor
 LR 0900-1200 Staff
 LB 1300-1700 MTuWTh

Biochemistry

FIRST SESSION

BCH 490 Special Studies in Biochemistry 1-3
 Prerequisite: Senior standing
 Hours arranged (15-490-001) Staff

\$ BCH 554 Radioisotope Techniques in Biology 2
 Prerequisite: BCH 451 or Consent of Instructor
 0800-1200 (15-554-001) Sisler
 May 20-June 10—Three-week course

BCH 590 Special Topics in Biochemistry Credits Arranged
 Prerequisite: BCH 451 or equivalent
 Hours arranged (15-590-001) Staff

BCH 695 Special Topics in Biochemistry Credits Arranged
 Prerequisite: Graduate standing in BCH
 Hours arranged (15-695-001) Staff

BCH 699 Biochemical Research Credits Arranged
 Hours arranged (15-699-001) Staff

SECOND SESSION

BCH 451 Introductory Biochemistry 3
 Prerequisite: CH 223
 0950-1120 (15-451-001) Main

BCH 490 Special Studies in Biochemistry 1-3
 Prerequisite: Senior standing
 Hours arranged (15-490-001) Staff

BCH 590 Special Topics in Biochemistry Credits Arranged
 Prerequisite: BCH 451 or equivalent
 Hours arranged (15-590-001) Staff

BCH 695 Special Topics in Biochemistry

Prerequisite: Graduate standing in BCH

Hours arranged (15-695-001)

Credits Arranged

Staff

BCH 699 Biochemical Research

Hours arranged (15-699-001)

Credits Arranged

Staff

Biomathematics**FIRST SESSION****BMA 591 Special Topics**

Prerequisite: Consent of Instructor

Hours arranged (18-591-001)

Maximum 3

Staff

BMA 691 Advanced Special Topics

Prerequisite: Consent of Instructor

Hours arranged (18-691-001)

1-3

Staff

BMA 699 Research

Hours arranged (18-699-001)

Credits Arranged

Staff

SECOND SESSION**BMA 591 Special Topics**

Prerequisite: Consent of Instructor

Hours arranged (18-591-001)

Maximum 3

Staff

BMA 691 Advanced Special Topics

Prerequisite: Consent of Instructor

Hours arranged (18-691-001)

1-3

Staff

BMA 699 Research

Hours arranged (18-699-001)

Credits Arranged

Staff

Botany**FIRST SESSION****\$ BO (ZO) 360 Introduction to Ecology**

(See Zoology)

4

\$ BO 421 Plant Physiology

Prerequisites: BS 100, or BS 105, or BO 200, and one year of college chemistry

LR 0800-0930 (19-421-001)

LB 1340-1750 MW (19-421-101)

LB 1340-1750 TuTh (19-421-102)

4

Troyer

SECOND SESSION**\$ BO 200 Plant Life**

LR 0800-0930 (19-200-001)

LB 1340-1750 MW (19-200-101)

LB 1340-1750 TuTh (19-200-102)

4

Beckmann

Biological Sciences

FIRST SESSION

\$ BS 100 General Biology

Students may not receive credit for both BS 100 and BS 105

LR 0800-0930 (17-100-001)

LB 1020-1300 TuTh (17-100-101)

LB 1340-1620 TuTh (17-100-102)

LB 1020-1300 WF (17-100-103)

LB 1340-1620 WF (17-100-104)

Wynn

BS 495A Special Topics in Biology

Prerequisite: Consent of Instructor and Teaching Coordinator

Hours arranged (17-495-001)

1-6

Staff

SECOND SESSION

BS 495A Special Topics in Biology

Prerequisite: Consent of Instructor and Teaching Coordinator

Hours arranged (17-495-001)

1-6

Staff

\$ BS 510 Advanced Biology for Secondary Teachers

Prerequisite: Consent of Instructor and Teaching Coordinator

LR 0800-0930 (17-510-001)

LB 1020-1230 and 1340-1550 MTuWTh (17-510-101)

June 23-July 25—Five Week Course

Lytle/Coffey

6

Civil Engineering

FIRST SESSION

CE 213 Introduction to Mechanics

Corequisite: MA 202

0730-0900 (22-213-001)

3

Staff

CE 214 Engineering Mechanics—Statics

Prerequisite: PY 205

Corequisite: MA 202

1050-1220 (22-214-001)

3

Staff

CE 215 Engineering Mechanics—Dynamics

Prerequisite: C or better in CE 214

Corequisite: MA 301

1440-1610 (22-215-001)

3

Staff

CE 313 Mechanics of Solids

Prerequisite: C or better in CE 214

Corequisite: MA 301

1300-1430 (22-313-001)

3

Staff

CE 464 Legal Aspects of Contracting

Prerequisite: Senior standing

0730-0900 (22-464-001)

3

Blessis

CE 498A Special Problems in Civil Engineering

Prerequisite: Senior standing

Hours arranged (22-498-001)

1-4

Wahls

CE 598 Civil Engineering Projects

Hours arranged (22-598-001)

1-6

Wahls

CE 698 Advanced Reading in Civil Engineering	1-3
Prerequisite: Graduate standing	
Hours arranged (22-698-001)	Wahls
CE 699 Civil Engineering Research	Credits Arranged
Hours arranged (22-699-001)	Zia

SECOND SESSION

CE 213 Introduction to Mechanics	3
Corequisite: MA 202	
0730-0900 (22-213-001)	Staff
CE 214 Engineering Mechanics—Statics	3
Prerequisite: PY 205	
Corequisite: MA 202	
0910-1040 (22-214-001)	Staff
CE 215 Engineering Mechanics—Dynamics	3
Prerequisite: C or better in CE 214	
Corequisite: MA 301	
1300-1430 (22-215-001)	Staff
CE 313 Mechanics of Solids	3
Prerequisite: C or better in CE 214	
Corequisite: MA 301	
1050-1220 (22-313-001)	Staff
CE 498A Special Problems in Civil Engineering	1-4
Prerequisite: Senior standing	
Hours arranged (22-498-001)	Wahls
CE 598 Civil Engineering Projects	1-6
Hours arranged (22-598-001)	Wahls
CE 698 Advanced Reading in Civil Engineering	1-3
Prerequisite: Graduate standing	
Hours arranged (22-698-001)	Wahls
CE 699 Civil Engineering Research	Credits Arranged
Hours arranged (22-699-001)	Zia

TEN-WEEK SESSION

CE 325 Structural Analysis	4
Prerequisites: CE 202 and CE 313	
LR 0910-1040 MWF (22-325-051)	Staff
LB 1050-1220 TuTh (22-325-151)	
\$ CE 326 Structural Engineering I	5
Prerequisite: CE 325	
0730-0900 (22-326-051)	Staff
\$ CE 382 Hydraulics	4
Prerequisites: CE 202, CE 215, MA 301	
LR 1050-1220 MWF (22-382-051)	Staff
LB 0730-0900 TuTh (22-382-151)	
LB 0910-1040 TuTh (22-382-152)	

Chemistry

FIRST SESSION

\$ CH 101 General Chemistry I

4

Prerequisite: MA 111 or equivalent

LR 0800-0930 (21-101-001)

Staff

LB 0940-1340 MW (21-101-101) (21-101-102) (21-101-103)

LB 1340-1750 MW (21-101-110) (21-101-111) (21-101-112)

\$ CH 104 Experimental Chemistry

1

Prerequisite: CH 101

Corequisite: CH 105

LB 1340-1750 MW (21-104-109)

Staff

CH 105 Chemistry Principles and Applications

3

Prerequisite: CH 101 with a grade of C or better. Credit cannot be received for both CH 105 and either CH 103 or CH 107.

0950-1120 (21-105-001)

Staff

\$ CH 107 Principles of Chemistry

4

Prerequisite: CH 101 with a grade of C or better.

LR 0950-1120 (21-107-001)

Staff

LB 1340-1750 MW (21-107-109) (21-107-113) (21-107-114) (21-107-115)

\$ CH 221 Organic Chemistry I

4

Prerequisite: CH 107

LR 0800-0930 (21-221-001)

Staff

LB 0940-1340 MW (21-221-101) (21-221-102) (21-221-103)

LB 1340-1750 MW (21-221-105) (21-221-106)

\$ CH 223 Organic Chemistry II

4

Prerequisite: CH 221

LR 0800-0930 (21-223-001)

Staff

LB 0940-1340 TuTh (21-223-109) (21-223-111)

LB 1340-1750 TuTh (21-223-112) (21-223-113)

\$ CH 315 Qualitative Analysis

4

Prerequisite: CH 103 or CH 107, or CH 104 *and* CH 105

LR 0800-0930 (21-315-001)

Staff

LB 0940-1340 MW (21-315-101)

LB 1340-1750 MW (21-315-102)

LB 0940-1340 TuTh (21-315-103)

CH 401 Systematic Inorganic Chemistry

3

Corequisite: CH 431 or CH 331

0950-1120 (21-401-001)

Staff

CH 431 Physical Chemistry I

3

Prerequisites: CH 107, MA 202, PY 203 or PY 208

Corequisite: MA 301

1140-1310 (21-431-001)

Staff

\$ CH 499 Senior Research in Chemistry

1-3

Prerequisite: Three years in Chemistry

Hours arranged (21-499-001)

Staff

CH 699 Chemical Research

Credits Arranged

Prerequisite: Graduate standing in Chemistry

Hours arranged (21-699-001)

Staff

SECOND SESSION

\$ CH 101 General Chemistry I	4
Prerequisite: MA 111 or equivalent	
LR 0800-0930 (21-101-001)	Staff
LB 0940-1340 MW (21-101-101) (21-101-102)	
LB 1340-1750 MW (21-101-110) (21-101-111)	
\$ CH 103 General Chemistry II	4
Prerequisite: CH 101	
LR 0800-0930 (21-103-001)	Staff
LB 0940-1340 MW (21-103-104) (21-103-105)	
LB 1340-1750 MW (21-103-112)	
\$ CH 104 Experimental Chemistry	1
Prerequisite: CH 101	
Corequisite: CH 105	
LB 1340-1750 MW (21-104-109)	Staff
CH 105 Chemistry Principles and Applications	3
Prerequisite: CH 101 with a grade of C or better. Credit cannot be received for both CH 105 and either CH 103 or CH 107.	
0950-1120 (21-105-001)	Staff
\$ CH 107 Principles of Chemistry	4
Prerequisite: CH 101 with a grade of C or better.	
LR 0950-1120 (21-107-001)	Staff
LB 1340-1750 MW (21-107-109) (21-107-113) (21-107-114) (21-107-115)	
\$ CH 221 Organic Chemistry I	4
Prerequisite: CH 107	
LR 0800-0930 (21-221-001)	Staff
LB 0940-1340 MW (21-221-101)	
LB 1340-1750 MW (21-221-105)	
\$ CH 223 Organic Chemistry II	4
Prerequisite: CH 221	
LR 0800-0930 (21-223-001)	Staff
LB 0940-1340 MW (21-223-109) (21-223-110)	
LB 1340-1750 MW (21-223-111) (21-223-112)	
CH 433 Physical Chemistry II	3
Prerequisites: CH 431 and MA 301	
1140-1310 (21-433-001)	Staff
\$ CH 499 Senior Research in Chemistry	1-3
Prerequisite: Three years in Chemistry	
Hours arranged (21-499-001)	Staff
CH 595T Special Topics in Chemistry: High School Teachers I	3
Prerequisite: Three years of Chemistry or equivalent teaching experience	
0950-1120 (21-595-001)	Staff
CH 699 Chemical Research	Credits Arranged
Prerequisite: Graduate standing in Chemistry	
Hours arranged (21-699-001)	Staff

Chemical Engineering

FIRST SESSION

\$ CHE 205 Chemical Process Principles	4
Prerequisites: C or better in MA 201, PY 205, CH 107	
Corequisite: MA 202	
1020-1230 (20-205-001)	Setzer

\$ CHE 497 Chemical Engineering Projects I	3
Prerequisites: Senior standing, CHE 330	
Hours arranged (20-497-001)	Setzer

CHE 699 Research	Credits Arranged
Hours arranged (20-699-001)	Hopfenberg

SECOND SESSION

\$ CHE 225 Chemical Process Systems	3
Prerequisites: PY 208, C or better in CHE 205	
Corequisite: MA 301	
LR 1020-1230 Th (20-225-001)	Marsland
LB 0950-1120 MWF (20-225-101)	
LB 1140-1310 MWF (20-225-102)	

\$ CHE 497 Chemical Engineering Projects I	3
Prerequisites: Senior standing, CHE 330	
Hours arranged (20-497-001)	Setzer

CHE 699 Research	Credits Arranged
Hours arranged (20-699-001)	Hopfenberg

CO-OP PROGRAM

TWELVE-WEEK SESSION

(Deadlines for Ten-Week Session apply)

Engineering Undergraduate Students Only

COP 100E Co-op Work Program	0
Hours arranged (25-100-051)	Weston

COP 200E Co-op Work Program	0
Hours arranged (25-200-051)	Weston

COP 300E Co-op Work Program	0
Hours arranged (25-300-051)	Weston

COP 400E Co-op Work Program	0
Hours arranged (25-400-051)	Weston

COP 500E Co-op Work Program	0
Hours arranged (25-500-051)	Weston

Forest Resources Undergraduate Students Only

COP 100F Co-op Work Program	0
Hours arranged (25-100-052)	Weston

COP 200F Co-op Work Program	0
Hours arranged (25-200-052)	Weston

COP 300F Co-op Work Program	0
Hours arranged (25-300-052)	Weston

COP 400F Co-op Work Program	0
Hours arranged (25-400-052)	Weston
COP 500F Co-op Work Program	0
Hours arranged (25-500-052)	Weston
Humanities and Social Sciences Undergraduate Students Only	
COP 100L Co-op Work Program	0
Hours arranged (25-100-053)	Weston
COP 200L Co-op Work Program	0
Hours arranged (25-200-053)	Weston
COP 300L Co-op Work Program	0
Hours arranged (25-300-053)	Weston
COP 400L Co-op Work Program	0
Hours arranged (25-400-053)	Weston
COP 500L Co-op Work Program	0
Hours arranged (25-500-053)	Weston
Physical and Mathematical Sciences Undergraduate Students Only	
COP 100P Co-op Work Program	0
Hours arranged (25-100-054)	Weston
COP 200P Co-op Work Program	0
Hours arranged (25-200-054)	Weston
COP 300P Co-op Work Program	0
Hours arranged (25-300-054)	Weston
COP 400P Co-op Work Program	0
Hours arranged (25-400-054)	Weston
COP 500P Co-op Work Program	0
Hours arranged (25-500-054)	Weston
Textiles Undergraduate Students Only	
COP 100T Co-op Work Program	0
Hours arranged (25-100-055)	Weston
COP 200T Co-op Work Program	0
Hours arranged (25-200-055)	Weston
COP 300T Co-op Work Program	0
Hours arranged (25-300-055)	Weston
COP 400T Co-op Work Program	0
Hours arranged (25-400-055)	Weston
COP 500T Co-op Work Program	0
Hours arranged (25-500-055)	Weston
Agriculture and Life Sciences Undergraduate Students Only	
COP 100A Co-op Work Program	0
Hours arranged (25-100-056)	Weston
COP 200A Co-op Work Program	0
Hours arranged (25-200-056)	Weston
COP 300A Co-op Work Program	0
Hours arranged (25-300-056)	Weston

COP 400A Co-op Work Program	0
Hours arranged (25-400-056)	Weston
COP 500A Co-op Work Program	0
Hours arranged (25-500-056)	Weston
Design Undergraduate Students Only	
COP 100D Co-op Work Program	0
Hours arranged (25-100-057)	Weston
COP 200D Co-op Work Program	0
Hours arranged (25-200-057)	Weston
COP 300D Co-op Work Program	0
Hours arranged (25-300-057)	Weston
COP 400D Co-op Work Program	0
Hours arranged (25-400-057)	Weston
COP 500D Co-op Work Program	0
Hours arranged (25-500-057)	Weston
Education Undergraduate Students Only	
COP 100W Co-op Work Program	0
Hours arranged (25-100-058)	Weston
COP 200W Co-op Work Program	0
Hours arranged (25-200-058)	Weston
COP 300W Co-op Work Program	0
Hours arranged (25-300-058)	Weston
COP 400W Co-op Work Program	0
Hours arranged (25-400-058)	Weston
COP 500W Co-op Work Program	0
Hours arranged (25-500-058)	Weston
Graduate Students Only	
COP 500N Co-op Work Program	0
Hours arranged. Full-time Alternating. (25-500-059)	Weston
COP 500R Co-op Work Program	0
Hours arranged. Part-time Parallel. (25-500-060)	Weston

Crop Science

FIRST SESSION

CS 591 Special Problems	Credits Arranged
Prerequisite: Consent of Instructor	
Hours arranged (24-591-001)	Emery
CS 699 Research	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (24-699-001)	Emery

SECOND SESSION

CS 591 Special Problems	Credits Arranged
Prerequisite: Consent of Instructor	
Hours arranged (24-591-001)	Emery

CS 699 Research

Credits Arranged

Prerequisite: Graduate standing

Hours arranged (24-699-001)

Emery

Computer Science**TEN-WEEK SESSION****\$ CSC 101E Introduction to Programming**

3

Prerequisite: MA 111

LR 1745-1930 MW (23-101-051)

E. Hodges

LB 1945-2130 MW (23-101-151) (23-101-152) (23-101-153) (23-101-154) (23-101-155)
(23-101-156)**\$ CSC 102E Programming Concepts**

3

Prerequisite: CSC 101

1745-1930 TuTh (23-102-051)

Lang

1945-2130 TuTh (23-102-052)

Lang

\$ CSC 111 Introduction to FORTRAN Programming

2

(MA 111 or equivalent is recommended before enrollment in this course)

0950-1120 TuTh (23-111-051)

Reid

CSC 200A Introduction to Computers and Their Uses

3

A student who has previously taken CSC 101 or CSC 111 may not receive credit for this course.

1300-1415 MW (23-200-051)

Saylor

NOTE: Students registering for CSC 200A must also register for CSC 200X

\$ CSC 200X Introduction to Computers Laboratory

0

1430-1730 M (23-200-151)

0900-1200 Tu (23-200-152)

1300-1600 Tu (23-200-153)

1430-1730 M (23-200-154)

0900-1200 Th (23-200-155)

1300-1600 Th (23-200-156)

CSC 200E Introduction to Computers and Their Uses

3

A student who has previously taken CSC 101 or CSC 111 may not receive credit for this course.

1745-1915 MW (23-200-052)

Saylor

NOTE: Students registering for CSC 200E must also register for CSC 200Y

\$ CSC 200Y Introduction to Computers Laboratory

0

1930-2230 M (23-200-160)

1745-2045 Tu (23-200-161)

1930-2230 W (23-200-162)

1745-2045 Th (23-200-163)

\$ CSC 201E Basic Computer Organization and Assembly Language

3

Prerequisite: CSC 101 or CSC 111

1745-1930 MW (23-201-051)

Love

1945-2130 MW (23-201-052)

Love

\$ CSC 252E Principles of Programming COBOL

1

Prerequisite: CSC 101

1745-1845 TuTh (23-252-051)

Staff

\$ CSC 311E Data Structures

3

Prerequisites: CSC 102 and CSC 201

1745-1930 MW (23-311-051)

L. Hodges

1945-2130 MW (23-311-052)

L. Hodges

CSC 322 Discrete Mathematical Structures	3
Prerequisite: MA 202	
Corequisite: CSC 311	
0910-1055 MW (23-322-051)	Williamson
\$ CSC 417 Theory of Programming Languages	3
Prerequisite: CSC 322	
1340-1525 MW (23-417-051)	Williamson
\$ CSC 499 Independent Research in Computer Science	1-6
Prerequisite: Consent of Department	
Hours arranged (23-499-051)	Funderlic

Computer Studies

FIRST SESSION

\$ CSE 457 Electric Circuits	1
Prerequisites: MA 202, PY 208 and B average in MA and PY	
0800-0850 MWF (09-457-001)	Stonick

SECOND SESSION

\$ CSE 458 Electronic Circuits	1
Prerequisite: CSE 457	
0800-0850 MWF (09-458-001)	Stonick

TEN-WEEK SESSION

\$ CSE 452 Assembly Language and Basic Computer Organization	1
Prerequisites: CSC 101 or equivalent and Consent of Instructor	
For Computer Studies majors or minors and Electrical and Computer Engineering graduate students. Other graduate students as appropriate.	
1745-1930 MW (09-452-051)	Love

\$ CSE 453 Data Structures	1
Prerequisites: CSC 101 or equivalent and Consent of Instructor	
For Computer Studies majors or minors and Electrical and Computer Engineering graduate students. Other graduate students as appropriate.	
1945-2130 MW (09-453-051)	Lang

CSE 693 Individual Topics in Computer Studies	1-3
Prerequisites: Graduate standing, Consent of Instructor	
Hours arranged (09-693-051)	Chou

\$ CSE 699 Computer Studies Research	Credits Arranged
Prerequisites: Graduate standing, Consent of Instructor	
Hours arranged (09-699-051)	Chou

Design

FIRST SESSION

\$ DN 251 Principles of Architectural Structures	3
LR 0950-1120 (26-251-001)	Harmon
LB 1340-1650 Th (26-251-101)	

\$ DN 253 Basic Environmental Systems	3
LR 1140-1310 (26-253-001)	Rifki
LB 1340-1650 F (26-253-101)	

\$ DN 254 Architectural Materials	3
LR 0800-0930 (26-254-001)	Rand
LB 1340-1650 W (26-254-101)	

DN 494A Internship in Design	3-6
Prerequisites: Junior standing and approval of program director.	
Maximum 6 credit hours.	
Hours arranged (26-494-001)	Burns
DN 494B Internship in Design	3-6
Prerequisites: Junior standing and approval of program director.	
Maximum 6 credit hours.	
Hours arranged (26-494-002)	Sullivan
DN 494C Internship in Design	3-6
Prerequisites: Junior standing and approval of program director.	
Maximum 6 credit hours.	
Hours arranged (26-494-003)	Foote
DN 495A Independent Study in Design	1-3
Prerequisites: Junior standing. Approval of program director and core chairman.	
Maximum 6 credit hours.	
Hours arranged (26-495-001)	Burns
DN 495B Independent Study in Design	1-3
Prerequisites: Junior standing. Approval of program director and core chairman.	
Maximum 6 credit hours.	
Hours arranged (26-495-002)	Sullivan
DN 495C Independent Study in Design	1-3
Prerequisites: Junior standing. Approval of program director and core chairman.	
Maximum 6 credit hours.	
Hours arranged (26-495-003)	Foote
SECOND SESSION	
DN 494A Internship in Design	3-6
Prerequisites: Junior standing and approval of program director.	
Maximum 6 credit hours.	
Hours arranged (26-494-001)	Burns
DN 494B Internship in Design	3-6
Prerequisites: Junior standing and approval of program director.	
Maximum 6 credit hours.	
Hours arranged (26-494-002)	Sullivan
DN 494C Internship in Design	3-6
Prerequisites: Junior standing and approval of program director.	
Maximum 6 credit hours.	
Hours arranged (26-494-003)	Staff
DN 495A Independent Study in Design	1-3
Prerequisites: Junior standing. Approval of program director and core chairman.	
Maximum 6 credit hours.	
Hours arranged (26-495-001)	Burns
DN 495B Independent Study in Design	1-3
Prerequisites: Junior standing. Approval of program director and core chairman.	
Maximum 6 credit hours.	
Hours arranged (26-495-002)	Sullivan
DN 495C Independent Study in Design	1-3
Prerequisites: Junior standing. Approval of program director and core chairman.	
Maximum 6 credit hours.	
Hours arranged (26-495-003)	Staff

Economics and Business

FIRST SESSION

EB 201 Economics I	3
Credit will not be awarded for both EB 201 and EB 212. Students interested in Agriculture and Natural Resources should enroll in EB 212 instead of this course.	
0800-0930 (27-201-001)	Hess
0800-0930 (27-201-002)	Staff
0950-1120 (27-201-003)	Hess
0950-1120 (27-201-004)	Staff
0950-1120 (27-201-005)	Staff
EB 202 Economics II	3
Prerequisite: EB 201 or EB 212	
0800-0930 (27-202-001)	Courchane
0950-1120 (27-202-002)	Courchane
EB 301 Intermediate Microeconomics	3
Prerequisites: MA 113 or MA 112 and EB 201 or EB 212	
0800-0930 (27-301-001)	Staff
0950-1120 (27-301-002)	Fearn
0950-1120 (27-301-003)	Staff
EB 302 Intermediate Macroeconomics	3
Prerequisites: EB 201 or EB 212; MA 113 or MA 112	
0800-0930 (27-302-001)	Rossana
0950-1120 (27-302-002)	Rossana
EB 307 Business Law I	3
Prerequisite: EB 201 or EB 212	
0950-1120 (27-307-001)	Peace
EB 313 Marketing Methods	3
Prerequisite: EB 201 or EB 212	
0800-0930 (27-313-001)	Gerstner
0950-1120 (27-313-002)	Gerstner
EB 326 Personnel Management	3
Prerequisite: EB 201 or EB 212	
0800-0930 (27-326-001)	W. Wessels
0950-1120 (27-326-002)	W. Wessels
EB (ST) 350 Economics and Business Statistics	3
Prerequisites: MA 113 or MA 112; MA 114; EB 201 or EB 212	
0800-0930 (27-350-001)	Hall
0950-1120 (27-350-002)	Hall
EB 371 Evolution of the American Economy	3
Prerequisite: EB 201 or EB 212	
1140-1310 (27-371-001)	Ball
EB 420 Corporation Finance	3
Prerequisites: EB 201 or EB 212, and ACC 260 or ACC 265	
0800-0930 (27-420-001)	Kupiec
1140-1310 (27-420-002)	Kupiec
EB 422 Investments and Portfolio Management	3
Prerequisites: EB 350 or ST 311 and EB 420	
0800-0930 (27-422-001)	Wilson
0950-1120 (27-422-002)	Wilson

EB 448 International Economics	3
Prerequisite: EB 301	
0800-0930 (27-448-001)	Ball
EB 501 Price Theory	3
Prerequisites: MA 113 and EB 301	
1340-1510 (27-501-001)	Fearn
EB 598 Topical Problems in Economics	1-6
Prerequisite: Consent of Instructor	
Hours arranged (27-598-001)	Staff
EB 699 Research in Economics	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (27-699-001)	Staff
SECOND SESSION	
EB 201 Economics I	3
Credit will not be awarded for both EB 201 and EB 212. Students interested in Agriculture and Natural Resources should enroll in EB 212 instead of this course.	
0800-0930 (27-201-001)	Flath
0950-1120 (27-201-002)	Flath
1140-1310 (27-201-003)	Staff
0950-1120 (27-201-004)	Staff
EB 202 Economics II	3
Prerequisite: EB 201 or EB 212	
0800-0930 (27-202-001)	Staff
0950-1120 (27-202-002)	Staff
EB 212 Economics of Agriculture	3
Prerequisite: MA 111. Credit will not be awarded for both EB 201 and EB 212.	
0800-0930 (27-212-001)	Peeler
0950-1120 (27-212-002)	Peeler
EB 301 Intermediate Microeconomics	3
Prerequisites: MA 113 or MA 112 and EB 201 or EB 212	
0950-1120 (27-301-001)	Knoeber
1140-1310 (27-301-002)	Knoeber
EB 302 Intermediate Macroeconomics	3
Prerequisites: MA 113 or MA 112; EB 201 or EB 212	
0950-1120 (27-302-001)	M. Fisher
1140-1310 (27-302-002)	M. Fisher
EB 307 Business Law I	3
Prerequisite: EB 201 or EB 212	
0950-1120 (27-307-001)	D. Baumer
EB 313 Marketing Methods	3
Prerequisite: EB 201 or EB 212	
0800-0930 (27-313-001)	Levedahl
0950-1120 (27-313-002)	Levedahl
EB 325 Managerial Economics	3
Prerequisite: EB 201 or EB 212	
0950-1120 (27-325-001)	Newmark
1140-1310 (27-325-002)	Newmark
EB 405 Regulatory Law	3
Prerequisite: EB 301	
1140-1310 (27-405-001)	D. Baumer

EB 598 Topical Problems in Economics	1-6
Prerequisite: Consent of Instructor	
Hours arranged (27-598-001)	Staff
EB 699 Research in Economics	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (27-699-001)	Staff

ADULT EDUCATION SESSION (See page 27)

\$ EB 415 Farm Appraisal and Finance	3
Prerequisite: EB 303 or EB 310	
0830-1200	Collender/Neuman

TEN-WEEK SESSION

EB 307E Business Law I	3
Prerequisite: EB 201 or EB 212	
1945-2130 MW (27-307-051)	Huggard
1745-1930 TuTh (27-307-052)	Carraway
EB 308E Business Law II	3
Prerequisite: EB 307	
1745-1930 MW (27-308-051)	Huggard
EB 502 Income and Employment Theory	3
Prerequisites: MA 113, EB 301 and EB 302, EB (ST) 350	
0945-1130 MW (27-502-051)	D. Fisher
EB 603 History of Economic Thought	3
Prerequisites: EB 501 and EB 502 or equivalent	
0945-1130 TuTh (27-603-051)	D. Fisher

Electrical and Computer Engineering

FIRST SESSION

ECE 331 Principles of Electrical Engineering I	3
Prerequisites: MA 201, PY 208	
Not available to EE and CPE majors	
0800-0930 (30-331-001)	Moore
ECE 435 Elements of Control	3
Prerequisites: ECE 301, ECE 302, ECE 314	
1745-1930 MTuWTh (30-435-001)	Wasson
ECE 699 Electrical Engineering Research	Credits Arranged
Prerequisite: Graduate standing in Electrical and Computer Engineering and approval of advisor	
Hours arranged (30-699-001)	Staff

SECOND SESSION

ECE 332 Principles of Electrical Engineering II	3
Prerequisite: ECE 331	
Not available to EE and CPE majors	
0800-0930 (30-332-001)	Moore
ECE 699 Electrical Engineering Research	Credits Arranged
Prerequisite: Graduate standing in Electrical and Computer Engineering and approval of advisor	
Hours arranged (30-699-001)	Staff

TEN-WEEK SESSION

ECE 211 Electric Circuits I	3
Prerequisites: PY 205, MA 201S	
Corequisites: PY 208, MA 202S (Note: students may satisfy the MA corequisite by scheduling MA 202S in the Second Summer Session)	
1140-1255 MWF (30-211-051)	Ybarra
ECE 212 Introduction to Logic and Microprocessors	3
Corequisite: CSC 101	
0950-1105 MWF (30-212-051)	Staff
\$ ECE 213 Electronic Circuits I, Laboratory	1
Prerequisite: ECE 211 (correspondence students)	
Corequisite: ECE 211	
1345-1635 M (30-213-051)	Staff
1135-1425 Tu (30-213-052)	Staff
1445-1735 Tu (30-213-053)	Staff
1345-1635 W (30-213-054)	Staff
1135-1425 Th (30-213-055)	Staff
1445-1735 Th (30-213-056)	Staff
\$ ECE 214 Introduction to Logic and Microprocessors Laboratory	1
Corequisite: ECE 212	
1135-1425 M (30-214-051)	Staff
1445-1735 M (30-214-052)	Staff
1135-1425 Tu (30-214-053)	Staff
1445-1735 Tu (30-214-054)	Staff
1135-1425 W (30-214-055)	Staff
1445-1735 W (30-214-056)	Staff
\$ ECE 301 Linear Systems	3
Prerequisite: A grade of C or better in ECE 211	
0950-1105 MWF (30-301-051)	Faber
\$ ECE 302 Electrical Circuits I with Numerical Applications	3
Prerequisites: CSC 101 and a grade of C or better in ECE 211	
0800-0915 MWF (30-302-051)	White

Education

FIRST SESSION

ED 203 Introduction to Teaching Mathematics and Science	3
0800-1120 (28-203-001)	Wheatley
ED 296 Special Topics in Education	1-3
Hours arranged (28-296-001)	Williams
ED 344 School and Society	3
Prerequisite: Junior or Senior standing	
1300-1530 (28-344-001)	Serow
ED 496 Special Topics in Education	1-3
Prerequisites: Junior or Senior standing and Consent of Instructor	
Hours arranged (28-496-001)	Williams
ED 506 Education of Exceptional Children	3
Prerequisite: Nine hours of ED or PSY	
1600-1900 TuTh (28-506-001)	Griffin

ED 513 Introduction to Issues and Techniques in Visual Impairments	3
Prerequisite: ED 506	
1300-1600 June 9-25 (28-513-001)	Staff
(See "Special Courses and Institutes", page 29)	
ED 523 Orientation and Mobility of the Visually Impaired	3
Prerequisite: Consent of Instructor	
0900-1200 June 9-25 (28-523-001)	Griffin
(See "Special Courses and Institutes", page 29)	
ED 526 Teaching in College	3
1530-1700 (28-526-001)	Anderson
ED 530 Theories and Techniques of Counseling	3
Prerequisite: Six hours of ED or PSY	
Corequisite: ED 520 or equivalent	
1600-1930 TuTh (28-530-001)	Gerler
ED 533 Group Counseling	3
Prerequisite: ED 530	
1600-1900 MW (28-533-001)	Gerler
ED 577 Improving Classroom Instruction in Science	3
Prerequisite: ED 475 or equivalent	
1600-1900 TuTh May 20-June 12 (28-577-001)	Wheatley
1200-1400 MWF June 16-25	
ED 590 Special Problems in Guidance	1-3
Prerequisites: Six hours graduate work in department or equivalent and Permission of Instructor	
Hours arranged (28-590-001)	Staff
ED 590A Special Problems in Guidance: Class Guidance for Teachers	1-3
Prerequisites: Six hours graduate work in department or equivalent and Permission of Instructor	
1600-1930 TuTh (28-590-002)	Locke
ED 592 Special Problems in Mathematics Teaching	1-3
Prerequisite: ED 471 or equivalent	
Hours arranged (28-592-001)	Staff
ED 594 Special Problems in Science Teaching	1-3
Prerequisite: ED 476 or equivalent	
Hours arranged (28-594-001)	Staff
ED 596 Topical Problems in Adult and Community College Education	Credits Arranged
Prerequisite: Graduate standing or PBS standing	
Hours arranged (28-596-001)	Staff
ED 596A Topical Problems in Adult and Community College Education: Death and Dying—A Lifespan Issue	3
Prerequisite: Graduate standing or PBS standing	
1600-1930 MW (28-596-002)	Glass
ED 596B Topical Problems in Adult and Community College Education: Adult Literacy Education in the United States	3
Prerequisite: Graduate standing or PBS standing	
1600-1930 TuTh (28-596-003)	Fingeret

ED 596C Topical Problems in Adult and Community College Education: Groups in Adult Education	3
Prerequisite: Graduate standing or PBS standing 1600-1930 TuTh (28-596-004)	Glass
ED 597 Special Problems in Education	1-3
Prerequisite: Graduate standing or PBS standing Hours arranged (28-597-001)	Staff
ED 597U Special Problems in Education: Personnel Appraisal	3
Prerequisite: Graduate standing or PBS status 1300-1800 M Taught at East Carolina University, Erwin Hall 210	MacPhail-Wilcox
ED 598 Special Problems in Curriculum and Instruction	1-6
Prerequisites: Six hours of ED or PSY and Consent of Instructor Hours arranged (28-598-001)	Staff
ED 598A Special Problems in Curriculum and Instruction: Alternatives in Middle Years Education	3
Prerequisites: Six hours of ED or PSY and Consent of Instructor 0900-1530 June 16-27 0900-1530 June 16-27 (For special registration instructions, see page 28)	Arnold Stevenson
ED 599 Research Projects in Education	1-3
Prerequisites: Consent of Instructor, ED 532 or equivalent Hours arranged (28-599-001)	Staff
ED 599A Research Projects in Education: ACCE	1-3
Prerequisites: Consent of Instructor, ED 532 or equivalent Hours arranged (28-599-002)	Staff
ED 621 Internship in Education	3-9
Prerequisites: Nine credit hours in graduate level courses and Consent of Instructor Hours arranged (28-621-001)	Staff
ED 625 Cross Cultural Counseling	3
Prerequisites: ED 530; 9 semester hours graduate level ED 1600-1930 MW (28-625-001)	Locke
ED 636 Observation and Supervised Field Work	3
Prerequisite: Consent of Instructor Hours arranged (28-636-001)	Staff
ED 699 Thesis and Dissertation Research	Credits Arranged
Prerequisites: 15 hours of Education; Consent of Instructor Hours arranged (28-699-001)	Staff
ED 699A Thesis and Dissertation Research: ACCE	Credits Arranged
Prerequisites: 15 hours of Education; Consent of Instructor Hours arranged (28-699-002)	Staff
SECOND SESSION	
ED 296 Special Topics in Education	1-3
Hours arranged (28-296-001)	Staff
ED 296A Special Topics in Education: Comprehensive College Reading	3
0800-0930 (28-296-003)	Mills
0950-1120 (28-296-004)	Mills
ED 296B Special Topics in Education: Medical Writing Skills	3
1745-2130 TuTh (28-296-002)	Davis

ED 496 Special Topics in Education	1-3
Prerequisites: Junior or Senior standing and Consent of Instructor	
Hours arranged (28-496-001)	Staff
ED 532 Introduction to Educational Inquiry	3
Prerequisite: Graduate standing or PBS status	
1140-1310 (28-532-001)	Marshall
1340-1510 (28-532-002)	Marshall
ED 541B Practicum in Education Administration	3
Prerequisites: ED 550 and Consent of Instructor	
Hours arranged (28-541-001)	Staff
ED 570 Foundations of Mathematics Education	3
Prerequisite: ED 471 or equivalent	
1140-1310 (28-570-001)	Waters
ED 580U Evaluation Theory and Practice in Education	3
Prerequisite: ED 532 or equivalent	
1300-1800 M To be taught at East Carolina University, Erwin Hall 210	Staff
ED 590 Special Problems in Guidance	1-3
Prerequisites: Six hours graduate work in department or equivalent and Permission of Instructor	
Hours arranged (28-590-001)	Staff
ED 592 Special Problems in Mathematics Teaching	1-3
Prerequisite: ED 471 or equivalent	
Hours arranged (28-592-001)	Staff
ED 594 Special Problems in Science Teaching	1-3
Prerequisite: ED 476 or equivalent	
Hours arranged (28-594-001)	Staff
ED 594A Special Problems in Science Teaching: Workshop in New Technology (Middle Schools)	3
Prerequisite: ED 476 or equivalent	
0800-1230 July 7-18 (28-594-003)	Park
(See "Special Courses and Institutes", page 28)	
ED 594B Special Problems in Science Teaching: Workshop in New Technology (High Schools)	3
Prerequisite: ED 476 or equivalent	
0800-1230 July 21-August 1 (28-594-004)	Park
(See "Special Courses and Institutes", page 28)	
ED 596 Topical Problems in Adult and Community College Education	Credits Arranged
Prerequisite: Graduate standing or PBS status	
Hours arranged (28-596-001)	Staff
ED 596D Topical Problems in Adult and Community College Education: Designing Staff Development Programs for Instructional Faculty in Two-Year Postsecondary Institutions	3
Prerequisite: Graduate standing or PBS status	
1600-1930 TuTh (28-596-005)	Colquitt
ED 597 Special Problems in Education	1-3
Prerequisite: Graduate standing or PBS status	
Hours arranged (28-597-001)	Staff
ED 598 Special Problems in Curriculum and Instruction	1-6
Prerequisites: Six hours of ED or PSY and Consent of Instructor	
Hours arranged (28-598-001)	Staff

ED 598D Special Problems in Curriculum and Instruction: Teaching of Writing Institute	6
Prerequisites: Six hours of ED or PSY and Consent of Instructor 0815-1530 (28-598-004) June 23-July 21 0815-1530 (28-598-005) (See "Special Courses and Institutes", page 29)	Pritchard Buckner
ED 598Y Special Problems in Curriculum and Instruction: Creativity	3
Prerequisites: Six hours of ED or PSY and Consent of Instructor 0900-1200 (28-598-006) July 1-23 (See "Special Courses and Institutes", page 29)	Aubrecht
ED 598J Special Problems in Curriculum and Instruction: Appropriate Services for Gifted Students	3
Prerequisites: Six hours of ED or PSY and Consent of Instructor 1300-1600 (28-598-007) July 1-23 (See "Special Courses and Institutes", page 29)	Aubrecht
ED 599 Research Projects in Education	1-3
Prerequisites: Consent of Instructor; ED 532 or equivalent Hours arranged (28-599-001)	Staff
ED 599A Research Projects in Education: ACCE	1-3
Prerequisites: Consent of Instructor; ED 532 or equivalent Hours arranged (28-599-002)	Staff
ED 621 Internship in Education	3-9
Prerequisites: Nine credit hours in graduate level courses and Consent of Instructor Hours arranged (28-621-001)	Staff
ED 636 Observation and Supervised Field Work	3
Prerequisite: Consent of Instructor Hours arranged (28-636-001)	Staff
ED 699 Thesis and Dissertation Research	Credits Arranged
Prerequisites: 15 hours of Education; Consent of Instructor Hours arranged (28-699-001)	Staff
ED 699A Thesis and Dissertation Research: ACCE	Credits Arranged
Prerequisites: 15 hours of Education; Consent of Instructor Hours arranged (28-699-002)	Staff
ADULT EDUCATION SESSION (See page 27)	
ED 503 The Programming Process in Adult & Community College Education	3
Prerequisites: ED 501, Consent of Instructor 0830-1200 June 16-July 3	Boone
ED 537 The Extension and Public Service Function in Higher Education	3
Prerequisite: ED 510 1300-1630 June 16-July 3	Filek
ED 579 Concepts and Principles of Evaluation Applied to Non-formal Adult Education Programs	3
Prerequisite: ED 503 or Consent of Instructor 0830-1200 June 16-July 3	Mustian
ED 596A Topical Problems in Adult and Community College Education: The Modern Practice of Adult Education	3
Prerequisite: Graduate standing or PBS status 0900-1200 & 1330-1630 June 16-27	Knowles

ED 596B Topical Problems in Adult and Community College Education: Instructional Leadership in the Community College	3
Prerequisite: Graduate standing or PBS status 0900-1200 & 1300-1600 June 16-27	Campbell
ED 596C Topical Problems in Adult and Community College Education: Microcomputer Applications in Adult & Extension Education	3
Prerequisite: Graduate standing or PBS status 0830-1200 June 16-July 3	Mrozek
ED 597A Special Problems in Education: Microcomputer Applications in Vocational Education	3
Prerequisite: Graduate standing or PBS status 1330-1630 June 16-July 3	Malpiedi
ED 597B Special Problems in Education: Advanced Methods of Teaching Vocational Education	3
Prerequisite: Graduate standing or PBS status 0900-1200 June 16-July 3	Malpiedi
ED 597C Special Problems in Education: Medical/Technical Writing	3
Prerequisite: Graduate standing or PBS status 1800-2130 June 16-July 3	Davis
ED 597D Special Problems in Education: Principles of Technology for Vocational Teachers	3
Prerequisite: Graduate standing or PBS status 0800-1140 June 16-July 3	Farmer
ED 601 Administrative Concepts and Theories Applied to Adult and Community College Education	3
Prerequisite: ED 600 or a comparable course(s) on organizational theory 1300-1630 June 16-July 3	Shearon

English

FIRST SESSION

FRESHMAN ENGLISH

ENG 111 Composition and Rhetoric	3
General University requirement. Successful completion of ENG 111 requires a grade of C or better. 0800-0930 (36-111-001)	Staff
0950-1120 (36-111-002)	Staff
1140-1310 (36-111-003)	Staff
ENG 112 Composition and Reading	3
General University requirement. Prerequisite: A grade of C or better in ENG 111. 0800-0930 (36-112-001)	Staff
0950-1120 (36-112-002)	Staff
1140-1310 (36-112-003)	Staff

WRITING AND LANGUAGE

The prerequisite for all courses in writing and language at the 200-level and above is the completion of ENG 111 and ENG 112.

ENG 215 Principles of News and Article Writing	3
0800-0930 (36-215-001)	Staff
ENG 221 Communication for Business and Management	3
0950-1120 (36-221-001)	Staff

ENG 315 Advanced News and Article Writing	3
1140-1310 (36-315-001)	Staff
ENG 321 The Communication of Technical Information	3
Prerequisite: Junior standing	
0800-0930 (36-321-001)	Staff
0950-1120 (36-321-002)	Staff
1140-1310 (36-321-003)	Staff
ENG 322 Advanced Composition and Rhetoric	3
0950-1120 (36-322-001)	Staff
LITERATURE	
<i>The prerequisite for all literature courses is the completion of ENG 111 and ENG 112.</i>	
ENG 205 Studies in Great Works of Literature	3
The courses ENG 205, ENG 206, ENG 207, and ENG 208 are designed for students not enrolled in Humanities and Social Sciences.	
0950-1120 (36-205-001)	Staff
ENG 208 Studies in Fiction	3
The courses ENG 205, ENG 206, ENG 207, and ENG 208 are designed for students not enrolled in Humanities and Social Sciences.	
0800-0930 (36-208-001)	Staff
0950-1120 (36-208-002)	Staff
1140-1310 (36-208-003)	Staff
ENG 251 Major British Writers	3
Credit will not be given for both ENG 251 and either ENG 261 or ENG 262.	
0950-1120 (36-251-001)	Staff
ENG 252 Major American Writers	3
Credit will not be given for both ENG 252 and either ENG 265 or ENG 266.	
1140-1310 (36-252-001)	Staff
ENG 261 English Literature I	3
0800-0930 (36-261-001)	Staff
ENG 262 English Literature II	3
0950-1120 (36-262-001)	Staff
ENG 265 American Literature I	3
0800-0930 (36-265-001)	Staff
0950-1120 (36-265-002)	Staff
1140-1310 (36-265-003)	Staff
ENG 266 American Literature II	3
0800-0930 (36-266-001)	Staff
0950-1120 (36-266-002)	Staff
ENG 298 Special Projects in English	1-3
0800-0930 (36-298-001)	Staff
ENG 469 American Realism and Naturalism	3
0800-0930 (36-469-001)	West
ENG 498 Special Topics in English	1-6
Prerequisite: Six hours in ENG above the freshman level.	
1140-1310 (36-498-001)	Staff

FOR GRADUATES ONLY

The prerequisite for all 600-level English courses is graduate standing unless additional prerequisites are noted.

ENG 575 Southern Writers	3
0950-1120 (36-575-001)	Grimwood
ENG 660 Victorian Poetry and Critical Prose	3
1140-1310 (36-660-001)	Harrison
ENG 698 Bibliography and Methodology	3
Hours arranged (36-698-001)	Thesis Director
ENG 699 Research in Literature (Thesis)	Credits Arranged
Prerequisite: Consent of graduate adviser.	
Hours arranged (36-699-001)	Thesis Director

SECOND SESSION

FRESHMAN ENGLISH

ENG 110 Developmental English	3
Credit is not applicable toward graduation in any curriculum. Students placed in ENG 110 must receive a grade of S in order to advance to ENG 111.	
0800-0930 (36-110-001)	Staff
ENG 111 Composition and Rhetoric	3
General University requirement.	
Successful completion of ENG 111 requires a grade of C or better.	
0800-0930 (36-111-001)	Staff
0950-1120 (36-111-002)	Staff
1140-1310 (36-111-003)	Staff
ENG 112 Composition and Reading	3
General University requirement.	
Prerequisite: A grade of C or better in ENG 111.	
0800-0930 (36-112-001)	Staff
0950-1120 (36-112-002)	Staff
1140-1310 (36-112-003)	Staff

WRITING AND LANGUAGE

The prerequisite for all courses in writing and language at the 200-level and above is the completion of ENG 111 and ENG 112.

ENG 214 Copyediting	3
0950-1120 (36-214-001)	Staff
ENG 221 Communication for Business and Management	3
0800-0930 (36-221-001)	Staff
ENG 321 The Communication of Technical Information	3
Prerequisite: Junior standing.	
0800-0930 (36-321-001)	Staff
0950-1120 (36-321-002)	Staff
1140-1310 (36-321-003)	Staff

LITERATURE

The prerequisite for all literature courses is the completion of ENG 111 and ENG 112.

ENG 205 Studies in Great Works of Literature

3

The courses ENG 205, ENG 206, ENG 207, and ENG 208 are designed for students not enrolled in Humanities and Social Sciences.

0950-1120 (36-205-001)

Staff

ENG 208 Studies in Fiction

3

The courses ENG 205, ENG 206, ENG 207, and ENG 208 are designed for students not enrolled in Humanities and Social Sciences.

0800-0930 (36-208-001)

Staff

0950-1120 (36-208-002)

Staff

1140-1310 (36-208-003)

Staff

ENG 251 Major British Writers

3

Credit will not be given for both ENG 251 and either ENG 261 or ENG 262.

1140-1310 (36-251-001)

Staff

ENG 252 Major American Writers

3

Credit will not be given for both ENG 252 and either ENG 265 or ENG 266.

0800-0930 (36-252-001)

Staff

ENG 261 English Literature I

3

0950-1120 (36-261-001)

Staff

ENG 262 English Literature II

3

0800-0930 (36-262-001)

Staff

ENG 265 American Literature I

3

0800-0930 (36-265-001)

Staff

0950-1120 (36-265-002)

Staff

ENG 266 American Literature II

3

0800-0930 (36-266-001)

Staff

0950-1120 (36-266-002)

Staff

1140-1310 (36-266-003)

Staff

ENG 298 Special Projects in English

1-3

0800-0930 (36-298-001)

Staff

ENG 380 Modern Drama

3

0800-0930 (36-380-001)

Halperen

ENG 439 17th-Century English Literature

3

0950-1120 (36-439-001)

Young

ENG 498 Special Topics in English

1-6

Prerequisite: Six hours in ENG above the freshman level.

1140-1310 (36-498-001)

Staff

FOR GRADUATES ONLY

The prerequisite for all 600-level English courses is graduate standing unless additional prerequisites are noted.

ENG 676 Twentieth-Century American Poetry

3

1140-1310 (36-676-001)

Reynolds

ENG 698 Bibliography and Methodology

3

Hours arranged (36-698-001)

Thesis Director

ENG 699 Research in Literature (Thesis)

Credits Arranged

Prerequisite: Consent of graduate adviser.

Hours arranged (36-699-001)

Thesis Director

TEN-WEEK SESSION**FRESHMAN ENGLISH****ENG 111E Composition and Rhetoric**

3

General University requirement.

Successful completion of ENG 111 requires a grade of C or better.

1745-1930 MW (36-111-051)

Staff

ENG 112E Composition and Reading

3

General University requirement.

Prerequisite: A grade of C or better in ENG 111.

1945-2130 MW (36-112-051)

Staff

WRITING AND LANGUAGE*The prerequisite for all courses in writing and language at the 200-level and above is the completion of ENG 111 and ENG 112.***ENG 321E The Communication of Technical Information**

3

1745-1930 MW (36-321-051)

Staff

LITERATURE*The prerequisite for all literature courses is the completion of ENG 111 and ENG 112.***ENG 208E Studies in Fiction**

3

The courses ENG 205, ENG 206, ENG 207, and ENG 208 are designed for students not enrolled in Humanities and Social Sciences.

1745-1930 TuTh (36-208-051)

Staff

1945-2130 TuTh (36-208-052)

Staff

ENG 261E English Literature I

3

1745-1930 MW (36-261-051)

Staff

ENG 265E American Literature I

3

1745-1930 TuTh (36-265-051)

Staff

1945-2130 TuTh (36-265-052)

Staff

Entomology**FIRST SESSION****\$ ENT (ZO) 425 General Entomology**

3

Prerequisite: ZO 201 or equivalent

LR 0800-0900 MWF (38-425-001)

Staff

LB 1340-1650 MW (38-425-101)

ENT 590 Special Problems

Credits Arranged

Prerequisite: Consent of Instructor

Hours arranged (38-590-001)

Staff

ENT 699 Research

Credits Arranged

Prerequisite: Graduate standing

Hours arranged (38-699-001)

Staff

SECOND SESSION**ENT 590 Special Problems**

Credits Arranged

Prerequisite: Consent of Instructor

Hours arranged (38-590-001)

Staff

ENT 591 Special Topics in Entomology: Field Ecology/Natural History	1
Prerequisite: Graduate standing	
Hours arranged (38-591-001)	Gould/Neunzig
ENT 699 Research	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (38-699-001)	Staff

Foreign Languages & Literatures

FRENCH

FIRST SESSION

\$ FLF 101 Elementary French I	3
0950-1120 (64-101-001)	Hammond
0950-1120 (64-101-002)	Paschal
\$ FLF 101E Elementary French I	3
1745-1930 (64-101-003)	Staff
\$ FLF 102 Elementary French II	3
Prerequisite: FLF 101	
0800-0930 (64-102-001)	Hammond
0800-0930 (64-102-002)	Staff
\$ FLF 201 Intermediate French I	3
Prerequisite: FLF 102 or FLF 105	
1140-1310 (64-201-001)	Paschal
1140-1310 (64-201-002)	Staff
FLF 308 French Conversation and Reading	3
Prerequisite: FLF 202	
1545-1730 (64-308-001)	Y. Rollins

SECOND SESSION

\$ FLF 102 Elementary French II	3
Prerequisite: FLF 101	
0800-0930 (64-102-001)	Staff
\$ FLF 102E Elementary French II	3
Prerequisite: FLF 101	
1745-1930 (64-102-002)	Staff
\$ FLF 201 Intermediate French II	3
Prerequisite: FLF 102 or FLF 105	
0950-1120 (64-201-001) (64-201-002)	Staff
FLF 202 Intermediate French II	3
Prerequisite: FLF 201	
1140-1310 (64-202-001)	Stack
FLF 401 French for Graduate Students	3
Not open to undergraduates.	
0950-1120 (64-401-001)	Stack

GERMAN

FIRST SESSION

\$ FLG 101 Elementary German I	3
0950-1120 (65-101-001)	Simonsen

FLG 201 Intermediate German I	3
Prerequisite: FLG 102	
0800-0930 (65-201-001)	Simonsen
FLG 401 German for Graduate Students	3
Not open to undergraduates	
0800-0930 (65-401-001)	Tucker
SECOND SESSION	
\$ FLG 102 Elementary German II	3
Prerequisite: FLG 101	
0950-1120 (65-102-001)	E. W. Rollins

SPANISH

FIRST SESSION	
\$ FLS 101 Elementary Spanish I	3
0800-0930 (68-101-001)	Feeny
0800-0930 (68-101-002)	G. Gonzalez
0800-0930 (68-101-003)	Alder
0800-0930 (68-101-004)	Malaxecheverria
\$ FLS 101E Elementary Spanish I	3
1745-1930 (68-101-005)	Cortes
\$ FLS 102 Elementary Spanish II	3
Prerequisite: FLS 101	
0950-1120 (68-102-001)	G. Gonzalez
0950-1120 (68-102-002)	Malaxecheverria
0950-1120 (68-102-003)	Staff
FLS 201 Intermediate Spanish I	3
Prerequisite: FLS 101 or FLS 105	
0950-1120 (68-201-001)	Feeny
0950-1120 (68-201-002)	Jezierski
1140-1310 (68-201-003)	Jezierski
SECOND SESSION	
\$ FLS 101 Elementary Spanish I	3
0800-0930 (68-101-001)	Malinowski
0800-0930 (68-101-002)	Cortes
\$ FLS 102 Elementary Spanish II	3
Prerequisite: FLS 101	
0950-1120 (68-102-001)	Kelly
0950-1120 (68-102-002)	Malinowski
0950-1120 (68-102-003) (68-102-004)	Staff
\$ FLS 102E Elementary Spanish II	3
Prerequisite: FLS 101	
1745-1930 (68-102-005)	Alonso
\$ FLS 201 Intermediate Spanish I	3
Prerequisite: FLS 102 or FLS 105	
1140-1310 (68-201-001) (68-201-002)	Staff
\$ FLS 201E Intermediate Spanish I	3
Prerequisite: FLS 102 or FLS 105	
0950-1120 (68-201-003)	Cortes

FLS 202 Intermediate Spanish II	3
Prerequisite: FLS 201	
0800-0930 (68-202-001)	Kelly
FL 495 Special Topics in Foreign Languages and Literatures:	3
Survey of Spanish Poetry	
Prerequisite: Consent of department	
1545-1730 (68-495-001)	Alonso

JAPANESE

FIRST SESSION

FLJ 105 Intensive Elementary Japanese	6
Combines FLJ 101 and FLJ 102	
0950-1120 (43-105-001)	Kataoka
1140-1310 (43-105-002)	Kataoka

SECOND SESSION

FLJ 205 Intensive Intermediate Japanese	6
Prerequisite: FLJ 105 or FLJ 102	
0950-1120 (43-205-001)	Takano
1140-1310 (43-205-002)	Takano

Forestry

FIRST SESSION

\$ FOR 111 Introduction to Field Forestry	2
Summer Pre-Camp (May 12-May 23)	
Open only to students transferring to a forestry major.	
0800-1700 (40-111-001)	Gregory/Cooper
\$ FOR 204 Silviculture	2
Summer Camp	
0800-1700 (40-204-001)	Jervis
\$ FOR 261 Forest Biology	2
Summer Camp	
Prerequisites: ENG 112, MA 114, BO 200 or equivalents, FOR 110, FOR 212. Transfer students FOR 111.	
0800-1700 (40-261-001)	Braham
\$ FOR 264 Forest Protection	2
Summer Camp	
Prerequisite: Junior standing in FOR	
0800-1700 (40-264-001)	Farrier/Grand
\$ FOR 274 Mapping and Mensuration	3
Summer Camp	
Prerequisites: MA 114, FOR 110 and FOR 212, or FOR 111 for transfer students.	
0800-1700 (40-274-001)	Jervis/Steensen
\$ FOR (FW) 310 Fisheries and Wildlife Inventory and Management	6
(See Fisheries and Wildlife)	
\$ FOR 591 Forestry Problems	Credits Arranged
Prerequisite: Advanced undergraduate or Graduate standing	
Hours arranged (40-591-001)	Staff
\$ FOR 691 Graduate Seminar	1
Prerequisite: Graduate standing	
Hours arranged (40-691-001)	Cooper

\$ FOR 699 Problems and Research	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (40-699-001)	Staff

SECOND SESSION

\$ FOR 591 Forestry Problems	Credits Arranged
Prerequisite: Advanced undergraduate or Graduate standing	
Hours arranged (40-591-001)	Staff

\$ FOR 691 Graduate Seminar	1
Prerequisite: Graduate standing	
Hours arranged (40-691-001)	Cooper

\$ FOR 699 Problems and Research	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (40-699-001)	Staff

Food Science

FIRST SESSION

FS 491 Special Topics in Food Science	1-6
Prerequisites: Twelve hours of Food Science and Consent of Instructor	
Hours arranged (39-491-001)	Staff

FS 591 Special Problems in Food Science	1-6
Prerequisite: Senior or Graduate standing	
Hours arranged (39-591-001)	Staff

FS 691 Special Research Problems in Food Science	Credits Arranged
Hours arranged (39-691-001)	Staff

FS 699 Research in Food Science	Credits Arranged
Hours arranged (39-699-001)	Staff

SECOND SESSION

FS 491 Special Topics in Food Science	1-6
Prerequisites: Twelve hours of Food Science and Consent of Instructor	
Hours arranged (39-491-001)	Staff

FS 591 Special Problems in Food Science	1-6
Prerequisite: Senior or Graduate standing	
Hours arranged (39-591-001)	Staff

FS 691 Special Research Problems in Food Science	Credits Arranged
Hours arranged (39-691-001)	Staff

FS 699 Research in Food Science	Credits Arranged
Hours arranged (39-699-001)	Staff

Fisheries and Wildlife

FIRST SESSION

FW (ZO) 221 Conservation of Natural Resources	3
0950-1120 (51-221-001)	Allen

\$ FW (FOR) 310 Fisheries and Wildlife Inventory and Management	6
Summer Camp	
Prerequisites: FW (ZO) 353 or FW (ZO) 420; Junior or Senior standing	
0800-1700 (51-310-001)	Staff

Graphic Communications

FIRST SESSION

GC 101 Engineering Graphics I

0800-0930 (98-101-001)

0800-0930 (98-101-002)

0950-1120 (98-101-003)

0950-1120 (98-101-004)

2

Webb

Crow

Webb

Crow

SECOND SESSION

GC 101 Engineering Graphics I

0800-0930 (98-101-001)

0800-0930 (98-101-002)

0950-1120 (98-101-003)

0950-1120 (98-101-004)

2

Vander Wall

Freeman

Vander Wall

Freeman

Genetics

FIRST SESSION

GN 301 Genetics in Human Affairs

Prerequisite: Students should have Sophomore standing

0800-0930 (41-301-001)

0950-1120 (41-301-002)

3

McKenzie

McKenzie

GN 411 The Principles of Genetics

Prerequisites: BS 100, Junior standing

1140-1310 (41-411-001)

3

Reid

GN 695 Special Problems in Genetics

Prerequisites: Advanced Graduate standing and Consent of Instructor

Hours arranged (41-695-001)

1-3

Staff

GN 699 Research

Prerequisites: Graduate standing, Consent of Advisor

Hours arranged (41-699-001)

Credits Arranged

Staff

SECOND SESSION

GN 695 Special Problems in Genetics

Prerequisites: Advanced Graduate standing and Consent of Instructor

Hours arranged (41-695-001)

1-3

Staff

GN 699 Research

Prerequisites: Graduate standing, Consent of Advisor

Hours arranged (41-699-001)

Credits Arranged

Staff

History

FIRST SESSION

HI 205 Western Civilization Since 1400

0800-0930 (44-205-001)

3

Wishy

HI 208 The Middle Ages

0950-1120 (44-208-001)

3

Novak

HI 210 Modern Europe 1815-Present

0800-0930 (44-210-001)

3

Vincent

HI 233 The World in the 20th Century

0950-1120 (44-233-001)

3

Vincent

HI 243 United States: 1845-1914	3
0950-1120 (44-243-001)	Crisp
HI 244 United States Since 1914	3
0950-1120 (44-244-001)	Hobbs
1140-1310 (44-244-002)	O'Brien
HI 364 History of North Carolina	3
0950-1120 (44-364-001)	O'Brien
HI 365 The American West	3
1140-1310 (44-365-001)	Crisp
HI 452 Recent America	3
Prerequisite: Three hours of History	
0800-0930 (44-452-001)	Hobbs
HI 498 Independent Study in History	1-6
Prerequisite: Three hours of History	
Hours arranged (44-498-001)	Staff
HI 598 Special Topics in History	1-6
Prerequisite: Six hours of advanced History or equivalent	
Hours arranged (44-598-001)	Staff
HI 699 Research in History	1-6
Prerequisite: Six hours of advanced History or equivalent	
Hours arranged (44-699-001)	Staff
SECOND SESSION	
HI 205 Western Civilization Since 1400	3
0950-1120 (44-205-001)	Howe
HI 207 Ancient World to 180 A.D.	3
0800-0930 (44-207-001)	Sack
HI 216 Latin America Since 1826	3
0950-1120 (44-216-001)	Slatta
HI 242 United States: 1783-1845	3
0950-1120 (44-242-001)	King
HI 243 United States: 1845-1914	3
0800-0930 (44-243-001)	King
HI 244 United States Since 1914	3
0800-0930 (44-244-001)	Slatta
1140-1310 (44-244-002)	Beezley
HI 333 History of American Sport	3
0950-1120 (44-333-001)	Beezley
HI 446 Civil War and Reconstruction	3
1140-1310 (44-446-001)	Smith
HI 546 Civil War and Reconstruction	3
1140-1310 (44-546-001)	Smith
HI 598 Special Topics in History	1-6
Prerequisite: Six hours of advanced History or equivalent	
Hours arranged (44-598-001)	Staff

HI 699 Research in History	1-6
Prerequisite: Six hours of advanced History or equivalent	
Hours arranged (44-699-001)	Staff

Horticultural Science

FIRST SESSION

\$ HS 101 Plants for Home and Pleasure	3
LR 1020-1120 (45-101-001)	Lane
LB 1340-1650 TuTh (45-101-101)	
HS 495 Special Topics in Horticultural Science	1-6
Hours arranged (45-495-001)	Staff
HS 595 Special Topics in Horticultural Science	1-6
Prerequisite: Consent of Instructor	
Hours arranged (45-595-001)	Staff
HS 599 Research Principles	1-6
Prerequisite: Consent of Instructor	
Hours arranged (45-599-001)	Staff
HS 695 Graduate Topics in Horticultural Science	1-6
Prerequisite: Consent of Instructor	
Hours arranged (45-695-001)	Staff
HS 699 Research	Credits Arranged
Prerequisites: Graduate Standing in Horticulture, Consent of Advisory Committee Chairman	
Hours arranged (45-699-001)	Staff

SECOND SESSION

\$ HS 371 Interior Landscapes	3
Prerequisites: BS 100 or BO 200; second semester Sophomore standing.	
LR 1020-1120 (45-371-001)	Lane
LB 1340-1650 TuTh (45-371-101)	
HS 495 Special Topics in Horticultural Science	1-6
Hours arranged (45-495-001)	Staff
HS 595 Special Topics in Horticultural Science	1-6
Prerequisite: Consent of Instructor	
Hours arranged (45-595-001)	Staff
HS 599 Research Principles	1-6
Prerequisite: Consent of Instructor	
Hours arranged (45-599-001)	Staff
HS 695 Graduate Topics in Horticultural Science	1-6
Prerequisite: Consent of Instructor	
Hours arranged (45-695-001)	Staff
HS 699 Research	Credits Arranged
Prerequisite: Graduate standing in Horticulture, Consent of Advisory Committee Chairman	
Hours arranged (45-699-001)	Staff

ADULT EDUCATION SESSION (See page 27)

HS 595A Special Topics in Horticultural Science: Production Management and Marketing of Quality Horticultural Crops	3
Prerequisite: Consent of Instructor	
0800-1700	G. Wilson

Industrial Arts

FIRST SESSION

\$ IA 115 Wood Processing I	3
1320-1610 (47-115-001)	DeLuca

\$ IA 122 Metal Technology I	3
1020-1310 (47-122-001)	Wenig

\$ IA 590 Laboratory Problems in Industrial Arts: Computer Applications—Industry and Education	3
-------------------------------------------------------------------------------------------------------	---

Prerequisites: Senior standing and Consent of Instructor	
1620-1810 (47-590-001)	DeLuca

SECOND SESSION

\$ IA 115 Wood Processing I	3
0730-1010 (47-115-001)	Troxler

\$ IA 351 General Ceramics	3
1020-1310 (47-351-001)	Troxler

Industrial Engineering

FIRST SESSION

IE 311 Engineering Economic Analysis	3
Prerequisite: MA 102 (non-engineering students may use MA 112 or MA 113)	
0800-0930 (49-311-001)	Staff

\$ IE 361 Deterministic Models in Industrial Engineering	3
Prerequisite: MA 303 or MA 405	
0950-1120 (49-361-001)	Chen

IE 495 Project Work in Industrial Engineering	1-6
Prerequisite: Senior standing	
Hours arranged (49-495-001)	Staff

IE 591 Project Work	1-6
Prerequisite: Graduate standing	
Hours arranged (49-591-001)	Staff

IE 651 Special Studies in Industrial Engineering	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (49-651-001)	Staff

IE 699 Industrial Engineering Research	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (49-699-001)	Staff

SECOND SESSION

IE 311 Engineering Economic Analysis	3
Prerequisite: MA 102 (non-engineering students may use MA 112 or MA 113)	
0950-1120 (49-311-001)	Staff

\$ IE 401 Stochastic Models in Industrial Engineering	3
Prerequisites: ST 371; MA 303 or MA 405	
0950-1120 (49-401-001)	Staff

IE 443 Quality Control	3
Prerequisite: ST 361	
LR 0800-0930 (49-443-001)	Prak
PR 1340-1550 MW (49-443-201)	

IE 495 Project Work in Industrial Engineering	1-6
Prerequisite: Senior standing	
Hours arranged (49-495-001)	Staff
IE 591 Project Work	1-6
Prerequisite: Graduate standing	
Hours arranged (49-591-001)	Staff
IE 651 Special Studies in Industrial Engineering	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (49-651-001)	Staff
IE 699 Industrial Engineering Research	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (49-699-001)	Staff

Landscape Architecture

FIRST SESSION

LAR 595 Independent Study	1-3
Prerequisite: Graduate standing	
Hours arranged (52-595-001)	Sullivan
LAR 691 Degree Seminar	0
Prerequisite: Three LAR 600 studios	
Hours arranged (52-691-001)	Sullivan
\$ LAR 698 Advanced Research Projects	2-6
Prerequisite: Two LAR 600 studios or Consent of Instructor	
Hours arranged (52-698-001)	Sullivan

SECOND SESSION

LAR 595 Independent Study	1-3
Prerequisite: Graduate standing	
Hours arranged (52-595-001)	Sullivan
LAR 691 Degree Seminar	0
Prerequisite: Three LAR 600 studios	
Hours arranged (52-691-001)	Sullivan
\$ LAR 698 Advanced Research Projects	2-6
Prerequisite: Two LAR 600 studios or Consent of Instructor	
Hours arranged (52-698-001)	Sullivan

Mathematics

FIRST SESSION

MA 102 Analytic Geometry and Calculus I	4
Prerequisite: MA 111 or equivalent completed in high school	
Credit not allowed for more than one of MA 102, MA 112, MA 113.	
0730-0940 (54-102-001) (54-102-002) (54-102-003)	Staff
1020-1230 (54-102-004) (54-102-005) (54-102-006)	Staff
MA 111 Algebra and Trigonometry	4
Credit is not allowed for both MA 100 and MA 111. For students in Engineering, Physical and Mathematical Sciences, Design, Biological and Agricultural Engineering (Science program), Biological Sciences (all options), and Mathematics Education, Science Education, credit in MA 111 does not count toward graduation.	
0730-0940 (54-111-001) (54-111-002)	Staff
1020-1230 (54-111-003) (54-111-004) (54-111-005)	Staff

MA 112 Analytic Geometry and Calculus A	4
Prerequisite: MA 111 or equivalent completed in high school	
Credit is not allowed for more than one of MA 102, MA 112, MA 113.	
0730-0940 (54-112-001)	Staff
1020-1230 (54-112-002)	Staff
MA 113 Elements of Calculus	4
Prerequisite: MA 111 or equivalent completed in high school	
Credit is not allowed in more than one of MA 102, MA 112, MA 113. MA 113 may not be substituted for MA 102 as a curricular requirement.	
0730-0940 (54-113-001) (54-113-002)	Staff
MA 114 Introduction to Finite Mathematics With Applications	3
Prerequisite: MA 111 or equivalent completed in high school	
0800-0930 (54-114-001) (54-114-002)	Staff
MA 115 Basic Algebra	4
Credit in MA 115 is not allowed if student has prior credit for MA 102, MA 111, MA 112, MA 113, or MA 114. Credit for graduation is not given for MA 115 in any curricula.	
0950-1200 (54-115-001)	Staff
MA 122 Mathematics of Finance	3
Prerequisite: MA 111 or MA 115 or equivalent completed in high school	
0800-0930 (54-122-001) (54-122-002)	Staff
MA 201 Analytic Geometry and Calculus II	4
Prerequisite: MA 102	
0730-0940 (54-201-001) (54-201-002)	Staff
1020-1230 (54-201-004) (54-201-005)	Staff
MA 201S Analytic Geometry and Calculus II	4
Prerequisites: MA 102S, EE major	
0730-0940 (54-201-007)	Staff
MA 202 Analytic Geometry and Calculus III	4
Prerequisite: MA 201	
0730-0940 (54-202-001) (54-202-002)	Staff
1020-1230 (54-202-003) (54-202-004)	Staff
MA 301 Applied Differential Equations I	3
Prerequisite: MA 202	
0800-0930 (54-301-001) (54-301-002)	Staff
1140-1310 (54-301-003) (54-301-004)	Staff
MA 405 Introduction to Linear Algebra and Matrices	3
Prerequisite: One year of calculus	
0800-0930 (54-405-001) (54-405-002)	Staff
1140-1310 (54-405-003)	Staff
MA 421 Introduction to Probability	3
Prerequisite: One year of calculus	
1140-1310 (54-421-001)	Staff
MA 501 Advanced Mathematics for Engineers and Scientists I	3
Prerequisite: MA 301 or equivalent. Credit for this course and MA 401 is not allowed.	
1140-1310 (54-501-001)	Staff
MA 511 Advanced Calculus I	3
Prerequisite: MA 301. May not be taken for credit by undergraduate mathematics majors.	
1140-1310 (54-511-001)	Staff
MA 512 Advanced Calculus II	3
Prerequisite: MA 301	
1140-1310 (54-512-001)	Staff

MA 513 Introduction to Complex Variables	3
Prerequisite: MA 202	
0800-0930 (54-513-001)	Staff
MA 699 Research	Credits Arranged
Hours arranged (54-699-001)	Franke
SECOND SESSION	
MA 100 Precalculus Trigonometry	2
Credit not allowed for both MA 100 and MA 111. Credit towards graduation is not given for MA 100 in any curricula.	
0730-0835 (54-100-001) (54-100-002)	Staff
1020-1125 (54-100-003)	Staff
MA 102 Analytic Geometry and Calculus I	4
Prerequisite: MA 111 or equivalent completed in high school	
Credit not allowed for more than one of MA 102, MA 112, MA 113.	
0730-0940 (54-102-001)	Staff
1020-1230 (54-102-002) (54-102-003)	Staff
MA 111 Algebra and Trigonometry	4
Credit is not allowed for both MA 100 and MA 111. For students in Engineering, Physical and Mathematical Sciences, Design, Biological and Agricultural Engineering (Science program), Biological Sciences (all options) and Mathematics Education, Science Education, credit in MA 111 does not count toward graduation requirements.	
0730-0940 (54-111-001) (54-111-002)	Staff
1020-1230 (54-111-004) (54-111-005) (54-111-006)	Staff
MA 112 Analytic Geometry and Calculus A	4
Prerequisite: MA 111 or equivalent completed in high school	
Credit is not allowed in more than one of MA 102, MA 112, MA 113.	
1020-1230 (54-112-001)	Staff
MA 113 Elements of Calculus	4
Prerequisite: MA 111 or equivalent completed in high school	
Credit is not allowed in more than one of MA 102, MA 112, MA 113. MA 113 may not be substituted for MA 102 as a curricular requirement.	
1020-1230 (54-113-001)	Staff
MA 114 Introduction to Finite Mathematics with Applications	3
Prerequisite: MA 111 or equivalent completed in high school	
0800-0930 (54-114-001) (54-114-002)	Staff
MA 115 Basic Algebra	4
Credit in MA 115 is not allowed if student has prior credit for MA 102, MA 111, MA 112, MA 113, or MA 114. Credit toward graduation is not given for MA 115 in any curricula.	
0730-0940 (54-115-001)	Staff
1030-1240 (54-115-002)	Staff
MA 201 Analytic Geometry and Calculus II	4
Prerequisite: MA 102	
0730-0940 (54-201-001) (54-201-002)	Staff
1020-1230 (54-201-003) (54-201-004)	Staff
MA 202 Analytic Geometry and Calculus III	4
Prerequisite: MA 201	
0730-0940 (54-202-001) (54-202-002)	Staff
1020-1230 (54-202-003) (54-202-004)	Staff
MA 202S Analytic Geometry and Calculus III	4
Prerequisite: MA 201S	
0730-0940 (54-202-005)	Staff

MA 212 Analytic Geometry and Calculus B	3
Prerequisite: MA 112	
1140-1310 (54-212-001)	Staff
MA 301 Applied Differential Equations I	3
Prerequisite: MA 202	
0800-0930 (54-301-001) (54-301-002)	Staff
1140-1310 (54-301-003) (54-301-004)	Staff
MA 401 Applied Differential Equations II	3
Prerequisite: MA 301. Credit for MA 401 and MA 501 will not be given.	
0800-0930 (54-401-001)	Staff
MA 405 Introduction to Linear Algebra and Matrices	3
Prerequisite: One year of calculus	
1140-1310 (54-405-001) (54-405-002)	Staff
MA 433 History of Mathematics	3
Prerequisite: One year of calculus	
0950-1120 (54-433-001)	Staff
MA 502 Advanced Mathematics for Engineers and Scientists II	3
Prerequisite: MA 301 or equivalent. Any student receiving credit for MA 502 may receive credit for, at most, one of the following: MA 405, MA 512, or MA 513.	
1140-1310 (54-502-001)	Staff
MA 512 Advanced Calculus II	3
Prerequisite: MA 301	
0800-0930 (54-512-001)	Staff
MA 699 Research	Credits Arranged
Hours arranged (54-699-001)	Franke
TEN-WEEK SESSION	
MA 111E Algebra and Trigonometry	4
Credit is not allowed for both MA 100 and MA 111. For students in Engineering, Physical and Mathematical Sciences, Design, Biological and Agricultural Engineering (Science program), Biological Sciences (all options), and Mathematics Education, Science Education credit in MA 111 does not count toward graduation.	
1915-2150 MW (54-111-051) (54-111-052)	Staff
MA 113E Elements of Calculus	4
Prerequisite: MA 111 or equivalent completed in high school	
Credit is not allowed in more than one of MA 102, MA 112, MA 113. MA 113 may not be substituted for MA 102 as a curricular requirement.	
1915-2150 TuTh (54-113-051)	Staff
MA 114E Introduction to Finite Mathematics with Applications	3
Prerequisite: MA 111 or equivalent completed in high school	
1945-2130 MW (54-114-051)	Staff

Mechanical and Aerospace Engineering

FIRST SESSION

MAE 206 Engineering Statics	3
Prerequisite: PY 205	
Corequisite: MA 202	
0800-0930 (55-206-001)	Staff
0950-1120 (55-206-002)	Staff

MAE 208 Engineering Dynamics	3
Prerequisite: MAE 206	
Corequisite: MA 301	
0800-0930 (55-208-001)	Brown
MAE 301 Engineering Thermodynamics I	3
Prerequisites: MA 202, PY 208 or PY 202	
0800-0930 (55-301-001)	Afify
0950-1120 (55-301-002)	Boles
0800-0930 (55-301-003)	Boles
1140-1310 (55-301-004)	Hodgson
MAE 302 Engineering Thermodynamics II	3
Prerequisite: A grade of C or better in MAE 301	
0950-1120 (55-302-001)	Afify
\$ MAE 305 Mechanical Engineering Laboratory I	1
Prerequisite: Junior standing in MAE	
1340-1750 TuTh (55-305-001)	Batton
1340-1750 MW (55-305-002)	Staff
1750-2200 MW (55-305-003)	Staff
1750-2200 TuTh (55-305-004)	Staff
MAE 308 Fluid Mechanics I	3
Prerequisites: MAE 206 or CE 213; MA 202	
1140-1310 (55-308-001)	Smetana
0800-0930 (55-308-002)	Staff
0950-1120 (55-308-003)	Brown
MAE 310 Conduction and Radiation Heat Transfer	3
Prerequisites: MA 301 and a grade of C or better in MAE 301	
0800-0930 (55-310-001)	Staff
0950-1120 (55-310-002)	Edwards
1140-1310 (55-310-003)	Staff
MAE 314 Solid Mechanics	3
Prerequisites: MAE 206, CE 213 or CE 214	
Corequisite: MAT 201	
0800-0930 (55-314-001)	Zorowski
0950-1120 (55-314-002)	Staff
1140-1310 (55-314-003)	Staff
MAE 410 Convective Heat Transfer and Fluid Flow	3
Prerequisites: MAE 301, MAE 308	
0800-0930 (55-410-001)	Edwards
\$ MAE 435 Principles of Automatic Control	3
Prerequisite: MA 301	
0950-1120 (55-435-001)	Smetana
MAE 586 Project Work in Mechanical Engineering	1-6
Hours arranged (55-586-001)	Staff
MAE 699 Mechanical Engineering Research	Credits Arranged
Prerequisites: Graduate standing in Mechanical Engineering and consent of advisor.	
Hours arranged (55-699-001)	Staff
SECOND SESSION	
MAE 206 Engineering Statics	3
Prerequisite: PY 205	
Corequisite: MA 202	
1140-1310 (55-206-001)	Staff
0800-0930 (55-206-002)	Staff

MAE 208 Engineering Dynamics	3
Prerequisite: MAE 206	
Corequisite: MA 301	
0800-0930 (55-208-001)	Smetana
MAE 261 Aerospace Vehicle Performance	3
Prerequisites: MA 201, PY 205	
0800-0930 (55-261-001)	Perkins
MAE 301 Engineering Thermodynamics I	3
Prerequisites: MA 202, PY 208 or PY 202	
0950-1120 (55-301-001)	Hale
0800-0930 (55-301-002)	Staff
1140-1310 (55-301-003)	Staff
1140-1310 (55-301-004)	Staff
0950-1120 (55-301-005)	Staff
MAE 302 Engineering Thermodynamics II	3
Prerequisite: A grade of C or better in MAE 301	
0950-1120 (55-302-001)	Perkins
\$ MAE 306 Mechanical Engineering Laboratory II	1
Prerequisite: MAE 305	
1340-1750 TuTh (55-306-001)	Batton
1340-1750 MW (55-306-002)	Staff
1750-2200 MW (55-306-003)	Staff
1750-2200 TuTh (55-306-004)	Staff
MAE 314 Solid Mechanics	3
Prerequisites: MAE 206; CE 213 or CE 214	
Corequisite: MAT 201	
0950-1120 (55-314-001)	Smetana
0800-0930 (55-314-002)	Staff
MAE 316 Strength of Mechanical Components	3
Prerequisite: MAE 314	
0950-1120 (55-316-001)	Garcia
MAE 411 Machine Component Design	3
Prerequisites: MAE 315, MAE 316	
0950-1120 (55-411-001)	Maday
\$ MAE 435 Principles of Automatic Control	3
Prerequisite: MA 301	
0800-0930 (55-435-001)	Maday
MAE 462 Flight Vehicle Stability and Control	3
Prerequisites: MAE 261, MAE 435	
0800-0930 (55-462-001)	Hale
MAE 586 Project Work in Mechanical Engineering	1-6
Hours arranged (55-586-001)	Staff
MAE 699 Mechanical Engineering Research	Credits Arranged
Prerequisites: Graduate standing in Mechanical Engineering and consent of advisor.	
Hours arranged (55-699-001)	Staff
TEN-WEEK SESSION	
MAE 208 Engineering Dynamics	3
Prerequisite: MAE 206	
Corequisite: MA 301	
0800-0915 MWF (55-208-051)	Staff

MAE 308 Fluid Mechanics I	3
Prerequisites: MAE 206 or CE 213; MA 202	
1140-1310 MWF (55-308-051)	Staff
MAE 315 Dynamics of Machines	3
Prerequisite: A grade of C or better in MAE 208	
1000-1115 MWF (55-315-051)	Neel

Materials Engineering

FIRST SESSION

MAT 201 Structure and Properties of Engineering Materials	3
Prerequisite: CH 105	
LR 1200-1330 (61-201-001)	Staff
PR 1340-1620 TuTh (61-201-201) (61-201-202)	
MAT 495 Materials Engineering Projects	1-6
Prerequisite: Junior or Senior standing	
Hours arranged (61-495-001)	Staff
MAT 595 Advanced Materials Experiments	1-3
Prerequisite: Senior or Graduate standing	
Hours arranged (61-595-001)	Staff
MAT 699 Materials Engineering Research	Credits Arranged
Hours arranged (61-699-001)	Staff

SECOND SESSION

\$ MAT 200 Mechanical Properties of Structural Materials	2
Prerequisites: CH 105 and the first course in ESM	
LR 1020-1120 MWF (61-200-001)	Fahmy
LB 1340-1650 MWF (61-200-101) (61-200-102)	
MAT 201 Structure and Properties of Engineering Materials	3
Prerequisite: CH 105	
LR 1200-1330 (61-201-001)	Fahmy
PR 1340-1620 TuTh (61-201-201) (61-201-202)	
MAT 495 Materials Engineering Projects	1-6
Prerequisite: Junior or Senior standing	
Hours arranged (61-495-001)	Staff
MAT 595 Advanced Materials Experiments	1-3
Prerequisite: Senior or Graduate standing	
Hours arranged (61-595-001)	Staff
MAT 699 Materials Engineering Research	Credits Arranged
Hours arranged (61-699-001)	Staff

Microbiology

FIRST SESSION

MB 490 Special Studies in Microbiology	1-3
Prerequisites: Three courses in Microbiology and permission of instructor	
Hours arranged (57-490-001)	Staff
MB 590 Topical Problems	Credits Arranged
Prerequisites: Graduate standing and Consent of Instructor	
Hours arranged (57-590-001)	Staff
MB 692 Special Problems in Microbiology	Credits Arranged
Hours arranged (57-692-001)	Staff

MB 699 Microbiology Research	Credits Arranged
Hours arranged (57-699-001)	Staff

SECOND SESSION

MB 490 Special Studies in Microbiology	1-3
Prerequisites: Three courses in Microbiology and permission of instructor	
Hours arranged (57-490-001)	Staff

MB 590 Topical Problems	Credits Arranged
Prerequisites: Graduate standing and Consent of Instructor	
Hours arranged (57-590-001)	Staff

MB 692 Special Problems in Microbiology	Credits Arranged
Hours arranged (57-692-001)	Staff

MB 699 Microbiology Research	Credits Arranged
Hours arranged (57-699-001)	Staff

Marine, Earth and Atmospheric Sciences

EARTH SCIENCE

FIRST SESSION

MEA 101 General Physical Geology	3
Credit may not be obtained for both MEA 101 and MEA 120	
0800-0930 (53-101-001)	Kimberley

\$ MEA 110 Physical Geology Laboratory	1
Corequisite: MEA 101 or MEA 120	
1020-1230 MW (53-110-001)	Staff
1340-1550 TuTh (53-110-002)	Staff

MEA 465 Geologic Field Camp I	3
Prerequisites: MEA 351, MEA 440, MEA 452	
First part of six weeks out-of-state summer field camp. Both MEA 465 and MEA 466 must be taken in the same summer.	
Hours arranged (53-465-001)	Brown

MEA 475 Geophysical Field Methods	2
Prerequisite: MEA 471	
Credit is not allowed for both MEA 475 and MEA 575	
Hours arranged (53-475-001)	Won/Bevis

MEA 575 Geophysical Field Methods	2
Prerequisite: MEA 470	
Credit is not allowed for both MEA 475 and MEA 575	
Hours arranged (53-575-001)	Won/Bevis

MEA 593G Special Topics	1-6
Prerequisite: Consent of Instructor	
Hours arranged (53-593-001)	Staff

MEA 698 Geophysical Research	Credits Arranged
Prerequisite: Consent of Instructor	
Hours arranged (53-698-001)	Staff

MEA 699G Research	Credits Arranged
Prerequisite: Consent of Instructor	
Hours arranged (53-699-001)	Staff

SECOND SESSION

MEA 101 General Physical Geology

Credit may not be obtained for both MEA 101 and MEA 120
0800-0930 (53-101-001)

3
Reymer

\$ MEA 110 Physical Geology Laboratory

Corequisite: MEA 101 or MEA 120
1020-1230 MW (52-110-001)
1340-1550 TuTh (53-110-002)

1
Staff
Staff

MEA 202 Historical Geology

Prerequisite: MEA 101 or MEA 120
0730-0900 (53-202-001)

3
Staff

MEA 210 Historical Geology Laboratory

Corequisite: MEA 202
1340-1550 MW (53-210-001)

1
Staff

MEA 466 Geologic Field Camp II

Prerequisite: MEA 465

Second part of six weeks out-of-state summer field camp. Both MEA 465 and MEA 466 must be taken in the same summer.

Hours arranged (53-466-001)

3
Fodor

MEA 593G Special Topics

Prerequisite: Consent of Instructor
Hours arranged (53-593-001)

1-6
Staff

MEA 698 Geophysical Research

Prerequisite: Consent of Instructor
Hours arranged (53-698-001)

Credits Arranged
Staff

MEA 699G Research

Prerequisite: Consent of Instructor
Hours arranged (53-699-001)

Credits Arranged
Staff

MARINE SCIENCE

FIRST SESSION

MEA 693 Advanced Special Topics

Prerequisites: Graduate standing and consent of staff
Hours arranged (53-693-001)

1-3
Staff

MEA 699S Research

Prerequisites: Graduate standing and consent of advisory committee
Hours arranged (53-699-002)

Credits Arranged
Staff

SECOND SESSION

MEA 593S Special Topics

Prerequisite: Consent of Instructor
Hours arranged (53-593-002)

1-3
Staff

MEA 693 Advanced Special Topics

Prerequisites: Graduate standing and consent of staff
Hours arranged (53-693-001)

1-3
Staff

MEA 699S Research

Prerequisites: Graduate standing and consent of advisory committee
Hours arranged (53-699-002)

Credits Arranged
Staff

ATMOSPHERIC SCIENCE

FIRST SESSION

MEA 593M Special Topics	1-6
Prerequisite: Consent of staff	
Hours arranged (53-593-002)	Staff
MEA 695M Seminar	1
Prerequisite: Graduate standing	
Hours arranged (53-695-001)	Staff
MEA 699M Research	Credits Arranged
Prerequisites: Graduate standing and consent of advisory committee	
Hours arranged (53-699-003)	Staff

SECOND SESSION

MEA 493A Special Topics in Meteorology	3
Prerequisite: Consent of staff	
0800-1040 (53-493-001)	Staff
MEA 493B Special Topics in Meteorology	3
Prerequisite: Consent of staff	
1100-1340 (53-493-002)	Staff
MEA 593M Special Topics	1-6
Prerequisite: Consent of staff	
Hours arranged (53-593-003)	Staff
MEA 695M Seminar	1
Prerequisite: Graduate standing	
Hours arranged (53-695-001)	Staff
MEA 699M Research	Credits Arranged
Prerequisites: Graduate standing and consent of advisory committee	
Hours arranged (53-699-003)	Staff

Music

FIRST SESSION

MUS 200 Understanding Music	3
0800-0930 (69-200-001)	Bliss
0950-1120 (69-200-002)	Hammond
MUS 210 A Survey of Music in America	3
0800-0930 (69-210-001)	Hammond
MUS 320 Music of the Twentieth Century	3
0950-1120 (69-320-001)	Bliss

SECOND SESSION

MUS 200 Understanding Music	3
0800-0930 (69-200-001)	Petters
0950-1120 (69-200-002)	Petters
0800-0930 (69-200-003)	Ward
MUS 215 Music of the 17th & 18th Centuries	3
0950-1120 (69-215-001)	Ward

Nuclear Engineering

FIRST SESSION

NE 491 Special Topics in Nuclear Engineering	1-4
Prerequisite: Consent of Instructor	
Hours arranged (70-491-001)	Staff

NE 591 Special Topics in Nuclear Engineering I	3
Prerequisite: Consent of Instructor	
Hours arranged (70-591-001)	Staff

NE 691 Advanced Topics in Nuclear Engineering I	3
Prerequisite: Consent of Instructor	
Hours arranged (70-691-001)	Staff

NE 699 Research in Nuclear Engineering	Credits Arranged	
Prerequisite: Graduate standing		
Hours arranged (70-699-001)		Staff

SECOND SESSION

NE 201 Applications of Nuclear Energy	3
Prerequisite: PY 208	
0950-1120 (70-201-001)	Stam

NE 491 Special Topics in Nuclear Engineering	1-4
Prerequisite: Consent of Instructor	
Hours arranged (70-491-001)	Stam

NE 591 Special Topics in Nuclear Engineering I	3
Prerequisite: Consent of Instructor	
Hours arranged (70-591-001)	Staff

NE 691 Advanced Topics in Nuclear Engineering I	3
Prerequisite: Consent of Instructor	
Hours arranged (70-691-001)	Staff

NE 699 Research in Nuclear Engineering	Credits Arranged	
Prerequisite: Graduate standing		
Hours arranged (70-699-001)		Staff

Nutrition

FIRST SESSION

NTR 699 Research in Nutrition	Credits Arranged	
Prerequisite: Graduate standing		
Hours arranged (71-699-001)		Staff

SECOND SESSION

NTR 699 Research in Nutrition	Credits Arranged	
Prerequisite: Graduate standing		
Hours arranged (71-699-001)		Staff

Operations Research

FIRST SESSION

OR 501 Introduction to Operations Research	3
Prerequisites: MA 421 or ST 421 or ST 371 and ST 372	
1020-1230 MTuW (73-501-051)	Salem
May 20-July 15—Eight Week Course—Final Exam July 15	

OR 591 Special Topics in Operations Research	1-3
Prerequisite: Consent of Instructor	
Hours arranged (73-591-001)	Staff
OR 691 Special Topics in Operations Research	3
Prerequisites: OR 501, OR (IE, MA) 505	
Hours arranged (73-691-001)	Staff
OR 699 Project in Operations Research	1-3
Hours arranged (73-699-001)	Staff

SECOND SESSION

OR 591 Special Topics in Operations Research	1-3
Prerequisite: Consent of Instructor	
Hours arranged (73-591-001)	Staff
OR 691 Special Topics in Operations Research	3
Prerequisites: OR 501, OR (IE, MA) 505	
Hours arranged (73-691-001)	Staff
OR 699 Project in Operations Research	1-3
Hours arranged (73-699-001)	Staff

Political Science & Public Administration

PUBLIC ADMINISTRATION

FIRST SESSION

*PA 516E Public Policy Analysis	3
Prerequisites: Advanced undergraduate standing including 12 hours of political science, Graduate standing or PBS status	
1900-2200 MW (34-516-001)	Swiss
PA 590 Readings and Research	1-3
Prerequisite: Graduate standing	
Hours arranged (34-590-001)	Staff
**PA 614E Management Systems	3
Prerequisites: Graduate standing or Management Development Certificate Program and six semester hours of 500-level course work	
1900-2200 TuTh (34-614-001)	Swiss
PA 691 Internship in Public Affairs	1-6
Prerequisite: Minimum 9 hours graduate work	
Hours arranged (34-691-001)	Staff

*There will be additional class meetings on June 7 and June 25. The final examination will be on June 27.

**There will be additional class meetings on June 7 and June 26. The final examination will be on June 27.

SECOND SESSION

PA 513E Financial Management in the Public Sector	3
Prerequisite: Graduate standing or PBS status	
1530-1730 MTuWTh (34-513-001)	Coe
PA 590 Readings and Research	1-3
Prerequisite: Graduate standing	
Hours arranged (34-590-001)	Staff

PA 612 The Budgetary Process	3
Prerequisites: Graduate standing or Management Development Certificate Program and six semester hours of 500-level course work	
0800-0930 MTuWTh (34-612-001)	Coe
PA 617E Seminar in Organization Theory	3
Prerequisites: Graduate standing or Management Development Certificate Program and six semester hours of 500-level course work	
1730-2030 MTuTh (34-617-001)	Vasu

POLITICAL SCIENCE

FIRST SESSION

PS 201 Introduction to American Government	3
0800-0930 (80-201-001)	Pavlik
0950-1120 (80-201-002)	Pavlik
PS 202 State and Local Government	3
0800-0930 (80-202-001)	Williams
PS 231 International Relations	3
0800-0930 (80-231-001)	McClintock
\$ PS 371 Research Methodology of Political Science	3
Prerequisite: PS 271 or PS 201 or Consent of Instructor	
0950-1120 (80-371-001)	Williams
PS 490 Readings and Research in Political Science	1-6
Prerequisite: Consent of the department	
Hours arranged (80-490-001)	Staff
PS 590 Readings and Research	1-3
Prerequisite: Graduate standing or PBS status	
Hours arranged (80-590-001)	Staff
PS 631 Seminar in International Relations	3
Prerequisite: Six semester hours of 500-level course work	
0950-1120 (80-631-001)	McClintock

SECOND SESSION

PS 201 Introduction to American Government	3
0800-0930 (80-201-001)	Holtzman
0950-1120 (80-201-002)	Staff
PS 236 Issues in Global Politics	3
0800-0930 (80-236-001)	Soroos
PS 301 The President and Congress	3
Prerequisite: PS 201	
0950-1120 (80-301-001)	Holtzman
PS 490 Readings and Research in Political Science	1-6
Prerequisite: Consent of department	
Hours arranged (80-490-001)	Staff
PS 590 Readings and Research	1-3
Prerequisite: Graduate standing or PBS status	
Hours arranged (80-590-001)	Staff

TEN-WEEK SESSION

PS 202E State and Local Government	3
1730-1930 MTh (80-202-051)	McClain

PS 491 Internship in Political Science

1-6

Prerequisite: Consent of Instructor

Hours arranged (80-491-051)

McClain

Product Design**FIRST SESSION****\$ PD 400 Intermediate Product Design (Series)**

6

Prerequisite: DF 102

0750-1300 (82-400-001)

Ater

PD 595 Independent Study in Product Design

1-3

Prerequisite: Graduate standing

Hours arranged (82-595-001)

Foote

PD 691 Special Topics in Product Design

1-6

Prerequisite: Graduate standing

Hours arranged (82-691-001)

Foote

SECOND SESSION**PD 595 Independent Study in Product Design**

1-3

Prerequisite: Graduate standing

Hours arranged (82-595-001)

Foote

PD 691 Special Topics in Product Design

1-6

Prerequisite: Graduate standing

Hours arranged (82-691-001)

Foote

Physical Education**FIRST SESSION****PE 100 (Coed) Health and Physical Fitness**

1

0830-0930 (75-100-001)

L. Brown

PE 112 Beginning Swimming

1

1300-1400 (75-112-001)

Almekinders

PE 221 Intermediate Swimming

1

1040-1140 (75-221-001)

Chastain

1400-1500 (75-221-002)

Almekinders

PE 221E Intermediate Swimming

1

1745-1845 MTuWTh (75-221-003)

Stewart

PE 226 Scuba Diving

1

Prerequisite: PE 225 or equivalent

1400-1500 (75-226-001)

L. Brown

1615-1715 MTuWTh (75-226-002)

Stewart

PE 229 Swim Conditioning

1

Prerequisite: PE 221

0940-1040 (75-229-001)

L. Brown

PE 231 Body Conditioning and Aerobics

1

0940-1040 (75-231-001)

Chastain

PE 232 Personal Defense for Women

1

0830-0930 (75-232-001)

Combs

PE 237 Weight Training

1

0940-1040 (75-237-001)

Combs

PE 237E Weight Training	1
1945-2045 MTuWTh (75-237-002)	Stewart
PE 242 Badminton	1
0940-1040 (75-242-001)	Cooper
1040-1140 (75-242-002)	Shannon
1200-1300 (75-242-003)	Daniels
1300-1400 (75-242-004)	Halstead
PE 243 Bowling	1
\$38.00 Bowling Fee	
1300-1400 (75-243-001)	Cooper
1400-1500 (75-243-002)	Cooper
PE 245 Golf	1
0940-1040 (75-245-001)	Gwyn
1040-1140 (75-245-002)	Gwyn
1300-1400 (75-245-003)	Gwyn
1400-1500 (75-245-004)	Gwyn
PE 249 Tennis I	1
0940-1040 (75-249-001)	Almekinders
1040-1140 (75-249-002)	Almekinders
1300-1400 (75-249-003)	Chastain
1400-1500 (75-249-004)	Chastain
PE 251 Target Archery	1
1040-1140 (75-251-001)	Halstead
1200-1300 (75-251-002)	L. Brown
PE 256 Racquetball	1
1500-1600 MTuWTh (75-256-001)	Stewart
PE 265 Softball	1
1040-1140 (75-265-001)	Cooper
1200-1300 (75-265-002)	Combs
1300-1400 (75-265-003)	Combs
PE 269 Volleyball	1
1040-1140 (75-269-001)	Daniels
PE 280 Emergency Medical Care and First Aid	2
This course does not constitute credit toward meeting Physical Education requirements.	
0830-0930 (75-280-001)	Daniels
SECOND SESSION	
PE 100 (Coed) Health and Physical Fitness	1
0830-0930 (75-100-001)	DeWitt
PE 112 Beginning Swimming	1
1300-1400 (75-112-001)	Rhodes
PE 221 Intermediate Swimming	1
1400-1500 (75-221-001)	Berle
PE 223 Advanced Lifesaving	1
Prerequisite: PE 221 or equivalent	
1040-1140 (75-223-001)	Goldberg
PE 226 Scuba Diving	1
Prerequisite: PE 225 or equivalent	
0940-1040 (75-226-001)	Goldberg

PE 231 Body Conditioning and Aerobics	1
1040-1140 (75-231-001)	Berle
1200-1300 (75-231-002)	Berle
PE 237 Weight Training	1
1200-1300 (75-237-001)	Rhodes
PE 240M Social Dance (Men Only)	1
0940-1040 (75-240-001)	Berle
PE 240W Social Dance (Women Only)	1
0940-1040 (75-240-002)	Berle
PE 242 Badminton	1
0940-1040 (75-242-001)	Wall
1200-1300 (75-242-002)	DeWitt
1300-1400 (75-242-003)	DeWitt
PE 243 Bowling	1
\$38.00 Bowling Fee	
1400-1515 MTuWTh (75-243-001)	Leath
PE 245 Golf	1
0940-1040 (75-245-001)	Brothers
1040-1140 (75-245-002)	Brothers
1300-1400 (75-245-003)	Brothers
PE 249 Tennis I	1
0830-0930 (75-249-001)	Rhodes
0940-1040 (75-249-002)	Rhodes
1040-1140 (75-249-003)	Wall
1400-1500 (75-249-004)	Wall
PE 249E Tennis I	1
1745-1845 MTuWTh (75-249-005)	Leath
PE 250 Tennis II	1
1615-1715 MTuWTh (75-250-001)	Leath
PE 256 Raquetball	1
0940-1040 (75-256-001)	DeWitt
PE 256E Racquetball	1
1945-2045 MTuWTh (75-256-002)	Leath
PE 269 Volleyball	1
1200-1300 (75-269-001)	Wall
PE 280 Emergency Medical Care and First Aid	2
This course does not constitute credit toward meeting Physical Education requirements.	
1300-1400 (75-280-001)	Goldberg

Philosophy

FIRST SESSION

PHI 201 Logic	3
0800-0930 (74-201-001)	Levin
0950-1120 (74-201-002)	Levin
PHI 205 Problems and Types of Philosophy	3
0800-0930 (74-205-001)	Bredenberg
0950-1120 (74-205-002)	Bredenberg
1140-1310 (74-205-003)	VanDeVeer

PHI 311 Philosophical Issues in Medical Ethics
0950-1120 (74-311-001)

3
VanDeVeer

PHI 340 Philosophy of Science
0800-0930 (74-340-001)
0950-1120 (74-340-002)

3
Austin
Austin

SECOND SESSION

PHI 201 Logic
0800-0930 (74-201-001)
0950-1120 (74-201-002)

3
Metzger
Metzger

PHI 205 Problems and Types of Philosophy
0800-0930 (74-205-001)
0950-1120 (74-205-002)
1140-1310 (74-205-003)

3
Hambourger
Carter
Regan

PHI 305 Philosophy of Religion
0950-1120 (74-305-001)

3
Hambourger

PHI 321 Contemporary Moral Issues
0950-1120 (74-321-001)

3
Regan

Physiology

FIRST SESSION

PHY 590 Special Problems in Physiology
Prerequisites: Graduate standing, Consent of Instructor
Hours arranged (78-590-001)

Credits Arranged

Britt

PHY 699 Physiological Research
Prerequisites: Graduate standing, Consent of Instructor
Hours arranged (78-699-001)

Credits Arranged

Britt

SECOND SESSION

PHY 699 Physiological Research
Prerequisites: Graduate standing, Consent of Instructor
Hours arranged (78-699-001)

Credits Arranged

Britt

Poultry Science

FIRST SESSION

PO 495 Special Problems in Poultry Science
Prerequisites: Junior standing and Consent of Instructor
Hours arranged (81-495-001)

1-6

Ort

PO 698 Special Problems in Poultry Science
Prerequisite: Graduate standing
Hours arranged (81-698-001)

1-6

Ort

PO 699 Poultry Research
Prerequisite: Graduate standing
Hours arranged (81-699-001)

Credits Arranged

Ort

SECOND SESSION

\$ PO (ANS) 204 Feeds and Feeding
(See Animal Science)

4

PO 495 Special Problems in Poultry Science	1-6
Prerequisites: Junior standing and Consent of Instructor	
Hours arranged (81-495-001)	Ort
PO 698 Special Problems in Poultry Science	1-6
Prerequisite: Graduate standing	
Hours arranged (81-698-001)	Ort
PO 699 Poultry Research	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (81-699-001)	Ort

Plant Pathology

FIRST SESSION

PP 595 Special Problems in Plant Pathology	Credits Arranged
Prerequisite: Consent of Instructor	Maximum 6
Hours arranged (79-595-001)	Klarman
PP 699 Research in Plant Pathology	Credits Arranged
Prerequisites: Graduate standing and Consent of Instructor	
Hours arranged (79-699-001)	Klarman

SECOND SESSION

PP 595 Special Problems in Plant Pathology	Credits Arranged
Prerequisite: Consent of Instructor	Maximum 6
Hours arranged (79-595-001)	Klarman
PP 699 Research in Plant Pathology	Credits Arranged
Prerequisites: Graduate standing and Consent of Instructor	
Hours arranged (79-699-001)	Klarman

TEN-WEEK SESSION

\$ PP 503 Plant Disease Diagnoses	4
Prerequisites: PP 501 and PP 502A, B, C or equivalent	
LB 0800-1800 MF (79-503-051)	Grand/Jones

Psychology

FIRST SESSION

PSY 200 Introduction to Psychology	3
0800-0930 (83-200-001)	Gray
0800-0930 (83-200-002)	Staff
0950-1120 (83-200-003)	Cunningham
1140-1310 (83-200-004)	Cunningham
PSY 304 Educational Psychology	3
0950-1120 (83-304-001)	Staff
PSY 376 Human Growth and Development	3
Prerequisites: PSY 200 and PSY 304	
0800-0930 (83-376-001)	Scott-Jones
PSY 475 Child Psychology	3
Prerequisite: PSY 200 or PSY 304	
0950-1120 (83-475-001)	Walker
1140-1310 (83-475-002)	Staff

PSY 499 Individual Study in Psychology	1-6
Prerequisite: Consent of Department	
Hours arranged (83-499-001)	Staff
PSY 533 Biological Factors in Abnormal Behavior	3
Prerequisites: 6 hours of PSY and 6 hours of Biology	
0800-1000 MTuWTh (83-533-001)	Kalat
PSY 599 Research Problems in Psychology	Credits Arranged
Prerequisite: Consent of Instructor	
Hours arranged (83-599-001)	Staff
PSY 693 Psychological Clinic Practicum	1-12
Prerequisite: Twelve hours in graduate Psychology, which must include clinical skill	
courses PSY 571 and PSY 672 and/or Consent of Instructor	
Hours arranged (83-693-001)	Staff
PSY 699 Thesis and Dissertation Research	Credits Arranged
Prerequisites: Graduate standing and Consent of Instructor	
Hours arranged (83-699-001)	Staff
SECOND SESSION	
PSY 200 Introduction to Psychology	3
0800-0930 (83-200-001)	Pond
0950-1120 (83-200-002)	Pond
1140-1310 (83-200-003)	Staff
1330-1500 (83-200-004)	Staff
PSY 304 Educational Psychology	3
0950-1120 (83-304-001)	Staff
1140-1310 (83-304-002)	Baker-Ward
PSY 475 Child Psychology	3
Prerequisite: PSY 200 or PSY 304	
1140-1310 (83-475-001)	Walker
PSY 476 Psychology of Adolescent Development	3
Prerequisite: Junior standing	
0950-1120 (83-476-001)	Snyder
PSY 499 Individual Study in Psychology	1-6
Prerequisite: Consent of Department	Staff
Hours arranged (83-499-001)	
PSY 504 Advanced Educational Psychology	3
Prerequisite: Six hours of PSY	
0950-1120 (83-504-001)	Baker-Ward
PSY 535 Tests and Measurement	3
Prerequisite: Six hours of Psychology	
0800-0930 (83-535-001)	Westbrook
0950-1120 (83-535-002)	Westbrook
PSY 577 Adolescent Development	3
Prerequisite: Six hours in PSY or Consent of Instructor	
0800-0930 (83-577-001)	Snyder
PSY 599 Research Problems in Psychology	Credits Arranged
Prerequisite: Consent of Instructor	
Hours arranged (83-599-001)	Staff

PSY 693 Psychological Clinic Practicum	1-12
Prerequisite: Twelve hours in graduate Psychology, which must include clinical skill courses PSY 571 and PSY 672 and/or Consent of Instructor	
Hours arranged (83-693-001)	Staff
PSY 699 Thesis and Dissertation Research	Credits Arranged
Prerequisites: Graduate standing and Consent of Instructor	
Hours arranged (83-699-001)	Staff

Physics

FIRST SESSION

\$ PY 205 General Physics	4
Prerequisite: MA 102	
LR 0800-0930 (77-205-001)	Staff
LR 0950-1120 (77-205-002)	Staff
LR 1140-1310 (77-205-003)	Staff
LB 0730-0940 MW (77-205-101)	
LB 1020-1230 MW (77-205-102)	
LB 1020-1230 TuTh (77-205-103)	
LB 1250-1500 MW (77-205-104)	
LB 1250-1500 TuTh (77-205-105)	
LB 1520-1730 MW (77-205-106)	
LB 1520-1730 TuTh (77-205-107)	
\$ PY 208 General Physics	4
Prerequisite: PY 205	
LR 0800-0930 (77-208-001)	Staff
LR 0950-1120 (77-208-002)	Staff
LB 1020-1230 MW (77-208-101)	
LB 1020-1230 TuTh (77-208-102)	
LB 1250-1500 MW (77-208-103)	
LB 1250-1500 TuTh (77-208-104)	
LB 1520-1730 MW (77-208-105)	
LB 1520-1730 TuTh (77-208-106)	
\$ PY 211 General Physics	4
Prerequisite: MA 111 or MA 116	
LR 0800-0930 (77-211-001)	Staff
LB 1250-1500 MW (77-211-101)	
LB 1250-1500 TuTh (77-211-102)	
\$ PY 212 General Physics	4
Prerequisite: PY 211	
LR 0950-1120 (77-212-001)	Staff
LB 1250-1500 MW (77-212-101)	
LB 1250-1500 TuTh (77-212-102)	
PY 221 College Physics	5
Prerequisite: MA 111 or MA 115	
1020-1300 (77-221-001)	Staff
\$ PY 231 Physics for Nonscientists	4
LR 0950-1120 (77-231-001)	Staff
LB 1250-1500 MW (77-231-101)	
PY 407 Introduction to Modern Physics	3
Prerequisites: MA 202, PY 208	
0800-0930 (77-407-001)	Staff

PY 499 Special Problems in Physics	1-6
Prerequisite: Consent of Department	
Hours arranged (77-499-001)	Staff
PY 590 Special Topics in Physics	Credits Arranged
Prerequisite: Consent of Department	
Hours arranged (77-590-001)	Staff
PY 699 Research	Credits Arranged
Hours arranged (77-699-001)	Staff
SECOND SESSION	
\$ PY 205 General Physics	4
Prerequisite: MA 102	
LR 0800-0930 (77-205-001)	Staff
LR 0950-1120 (77-205-002)	Staff
LR 1140-1310 (77-205-003)	Staff
LB 0730-0940 MW (77-205-101)	
LB 1020-1230 MW (77-205-102)	
LB 1020-1230 TuTh (77-205-103)	
LB 1250-1500 MW (77-205-104)	
LB 1250-1500 TuTh (77-205-105)	
LB 1520-1730 MW (77-205-106)	
LB 1520-1730 TuTh (77-205-107)	
\$ PY 208 General Physics	4
Prerequisite: PY 205	
LR 0800-0930 (77-208-001)	Staff
LR 0950-1120 (77-208-002)	Staff
LR 1140-1310 (77-208-003)	Staff
LB 0730-0940 MW (77-208-101)	
LB 1020-1230 MW (77-208-102)	
LB 1020-1230 TuTh (77-208-103)	
LB 1250-1500 MW (77-208-104)	
LB 1250-1500 TuTh (77-208-105)	
LB 1520-1730 MW (77-208-106)	
\$ PY 211 General Physics	4
Prerequisite: MA 111 or MA 116	
LR 0950-1120 (77-211-001)	Staff
LB 1250-1500 MW (77-211-101)	
LB 1250-1500 TuTh (77-211-102)	
\$ PY 212 General Physics	4
Prerequisite: PY 211	
LR 0800-0930 (77-212-001)	Staff
LB 1250-1500 MW (77-212-101)	
LB 1250-1500 TuTh (77-212-102)	
PY 221 College Physics	5
Prerequisite: MA 111 or MA 115	
1020-1300 (77-221-001)	Staff
PY 499 Special Problems in Physics	1-6
Prerequisite: Consent of Department	
Hours arranged (77-499-001)	Staff
PY 531 Advanced Placement Physics for Secondary School Teachers	6
Prerequisite: Teaching Certificate	
0800-1200 (77-531-001)	Staff

PY 590 Special Topics in Physics
 Prerequisite: Consent of Department
 Hours arranged (77-590-001)

Credits Arranged

Staff

PY 699 Research
 Hours arranged (77-699-001)

Credits Arranged
 Staff

Religion

FIRST SESSION

REL 300 Introduction to Religion
 0800-0930 (87-300-001)
 0950-1120 (87-300-002)

3
 Highfill
 Highfill

REL 312 Introduction to the New Testament
 0800-0930 (87-312-001)
 0950-1120 (87-312-002)

3
 VanderKam
 VanderKam

SECOND SESSION

REL 300 Introduction to Religion
 0800-0930 (87-300-001)
 0950-1120 (87-300-002)

3
 Mullin
 Mullin

Recreation Resources Administration

FIRST SESSION

RRA 152 Introduction to Recreation
 0800-0930 (85-152-001)
 0950-1120 (85-152-002)
 1520-1650 (85-152-003)

3
 Sternloff
 Sternloff
 Rea

RRA 475 Recreation and Park Internship
 Prerequisites: Senior standing, RRA 359
 Hours arranged (85-475-001)
 Hours arranged (85-475-002)

9
 Kirsch
 Wilson

RRA 591 Recreation Resources Problems
 Prerequisite: Advanced undergraduate or Graduate standing
 Hours arranged (85-591-001)

1-4
 Staff

RRA 595 Special Topics in Recreation Resources: Foundations for Sport and Fitness Management

3

Prerequisites: Graduate standing; Consent of Instructor
 0950-1120 (85-595-001)

Rea

RRA 692 Advanced Problems in Recreation
 Prerequisite: Twelve hours RRA courses
 Hours arranged (85-692-001)

Credits Arranged
 Staff

RRA 699 Research in Recreation
 Prerequisite: Twelve hours RRA courses
 Hours arranged (85-699-001)

Credits Arranged
 Staff

SECOND SESSION

RRA 152 Introduction to Recreation
 0800-0930 (85-152-001)
 0950-1120 (85-152-002)

3
 Love
 Love

RRA 591 Recreation Resources Problems	1-4
Prerequisite: Advanced undergraduate or Graduate standing	
Hours arranged (85-591-001)	Staff
RRA 692 Advanced Problems in Recreation	Credits Arranged
Prerequisite: Twelve hours RRA courses	
Hours arranged (85-692-001)	Staff
RRA 696 Seminar in Recreation Research	1
Prerequisite: RRA 501	
Hours arranged (85-696-001)	Staff
RRA 699 Research in Recreation	Credits Arranged
Prerequisite: Twelve hours RRA courses	
Hours arranged (85-699-001)	Staff

Sociology

FIRST SESSION

SOC 202 Principles of Sociology	3
0730-0900 (92-202-001)	Staff
0800-0930 (92-202-002)	Staff
0950-1120 (92-202-003)	Della Fave
0950-1120 (92-202-004)	Staff
1140-1310 (92-202-005)	Devey
SOC 202E Principles of Sociology	3
1745-1930 MTuWTh (92-202-006)	Staff
SOC 203 Current Social Problems	3
0950-1120 (92-203-001)	Staff
SOC 204 Sociology of Family	3
0800-0930 (92-204-001)	Staff
0950-1120 (92-204-002)	Uzzell
1140-1310 (92-204-003)	Uzzell
SOC 204E Sociology of Family	3
1745-1930 MTuWTh (92-204-004)	Staff
1945-2130 MTuWTh (92-204-005)	Staff
SOC 205 Work: Occupations and Professions	3
0950-1120 (92-205-001)	Devey
SOC 301 Human Behavior	3
Prerequisite: SOC 202 or PSY 200	
0800-0930 (92-301-001)	Hyman
0950-1120 (92-301-002)	Hyman
SOC 305 Race and Ethnic Relations	3
Prerequisite: Three credits in SOC	
1140-1310 (92-305-001)	Della Fave
SOC 306 Criminology	3
Prerequisite: Three credits in SOC	
0800-0930 (92-306-001)	Hill
SOC 425 Juvenile Delinquency	3
Prerequisite: SOC 202; SOC 301 desirable	
0950-1120 (92-425-001)	Hill

SOC 498 Special Topics in Sociology	1-6
Prerequisite: Six hours of SOC above the 200 level	
Hours arranged (92-498-001)	Walek
SOC 591 Special Topics in Sociology	1-6
Prerequisite: Consent of Instructor	
Hours arranged (92-591-001)	Moxley
SOC 595 Practicum in Sociology	3-6
Prerequisite: Graduate standing in the Master of Sociology program and 9 hours of SOC at the 500-600 level.	
Hours arranged (92-595-001)	Moxley
SOC 699 Research in Sociology	Credits Arranged
Prerequisite: Consent of chairman of graduate study committee	
Hours arranged (92-699-001)	Moxley
SECOND SESSION	
SOC 202 Principles of Sociology	3
0800-0930 (92-202-001)	Staff
0800-0930 (92-202-002)	Dawson
0950-1120 (92-202-003)	Dawson
0950-1120 (92-202-004)	Staff
1140-1310 (92-202-005)	Staff
SOC 202E Principles of Sociology	3
1745-1930 MTuWTh (92-202-006)	Staff
SOC 203 Current Social Problems	3
0950-1120 (92-203-001)	Staff
SOC 204 Sociology of Family	3
0800-0930 (92-204-001)	Thomson
0800-0930 (92-204-002)	Troost
0950-1120 (92-204-003)	Troost
0950-1120 (92-204-004)	Thomson
1140-1310 (92-204-005)	Staff
SOC 204E Sociology of Family	3
1745-1930 MTuWTh (92-204-006)	Staff
1945-2130 MTuWTh (92-204-007)	Staff
SOC 205 Work: Occupations and Professions	3
0950-1120 (92-205-001)	Leiter
SOC 301 Human Behavior	3
Prerequisite: SOC 202 or PSY 200	
0800-0930 (92-301-001)	Brisson
0950-1120 (92-301-002)	Staff
SOC 305 Race and Ethnic Relations	3
Prerequisite: Three credits in SOC	
0800-0930 (92-305-001)	Woodrum
SOC 306 Criminology	3
Prerequisite: Three credits in SOC	
0950-1120 (92-306-001)	Suval
SOC 415 Social Thought	3
Prerequisite: SOC 202	
0950-1120 (92-415-001)	Woodrum

\$ SOC 416 Research Methods	3
Prerequisites: Senior standing, ST 311 or Consent of Instructor 1140-1310 (92-416-001)	Leiter
SOC 498 Special Topics in Sociology	1-6
Prerequisite: Six hours SOC above the 200 level Hours arranged (92-498-001)	Walek
SOC 501 Leadership	3
Prerequisite: SOC 202 or equivalent 0950-1120 (92-501-001)	Brisson
SOC 515 Deviant Behavior	3
Prerequisite: Six hours SOC or ANT or graduate standing or PBS status 0800-0930 (92-515-001)	Suval
SOC 591 Special Topics in Sociology	1-6
Prerequisite: Consent of Instructor Hours arranged (92-591-001)	Moxley
SOC 595 Practicum in Sociology	3-6
Prerequisite: Graduate standing in the Master of Sociology program and nine hours of SOC at 500-600 level. Hours arranged (92-595-001)	Moxley
SOC 699 Research in Sociology	Credits Arranged
Prerequisite: Consent of chairman of graduate study committee Hours arranged (92-699-001)	Moxley

Speech-Communication

FIRST SESSION

SP 101 Speech Improvement	3
Not accepted for area emphasis requirement in Public Communication 0950-1120 (37-101-001)	Staff
SP 103 Introduction to the Theatre	3
0800-0930 (37-103-001)	Russell
0950-1120 (37-103-002)	Russell
SP 110 Public Speaking	3
0800-0930 (37-110-001)	Schrag
0800-0930 (37-110-002)	Franklin
0950-1120 (37-110-003)	Schrag
0950-1120 (37-110-004)	Parker
1140-1310 (37-110-005)	Parker
SP 112 Basic Principles of Interpersonal Communication	3
0800-0930 (37-112-001)	DeJoy
0950-1120 (37-112-002)	DeJoy
0950-1120 (37-112-003)	Leonard
1140-1310 (37-112-004)	Leonard
SP 312 Barriers to Organizational Communication	3
0950-1120 (37-312-001)	Munn
SP 498A Special Topics in Speech-Communication: Interviewing	3
Prerequisites: 9 hours of SP and Junior standing and permission of the department 0800-0930 (37-498-001)	Munn

SECOND SESSION

SP 110 Public Speaking	3
0800-0930 (37-110-001)	Long
0950-1120 (37-110-002)	Camp
1140-1310 (37-110-003)	Camp
SP 112 Basic Principles of Interpersonal Communication	3
0800-0930 (37-112-001)	Anderson
0950-1120 (37-112-002) (37-112-003)	Staff
1140-1310 (37-112-004) (37-112-005)	Staff
SP 304 Survey of Telecommunication	3
0950-1120 (37-304-001)	Funkhouser
SP 322 Nonverbal Communication	3
0950-1120 (37-322-001)	Anderson
SP 354 Portable Video Production	3
1140-1310 (37-354-001)	Funkhouser

Statistics

FIRST SESSION

ST 311 Introduction to Statistics	3
0950-1120 (94-311-001)	Stines
ST (EB) 350 Economics and Business Statistics	3
Prerequisites: MA 113 or MA 112; MA 114; EB 201 or EB 212 or equivalent	
0800-0930 (94-350-001)	Hall
0950-1120 (94-350-002)	Hall
ST 361 Introduction to Statistics for Engineers	3
Prerequisite: College Algebra	
0800-0930 (94-361-001)	Dietz
ST 371 Introduction to Probability and Distribution Theory	3
Prerequisite: MA 201	
0950-1120 (94-371-001)	Wesler
0800-0930 (94-371-002)	Wesler
ST 493 Special Topics in Statistics	1-3
Prerequisite: Consent of Instructor	
Hours arranged (94-493-001)	Staff
ST 511S Experimental Statistics I	3
Prerequisite: ST 311 or Graduate standing	
1140-1310 (94-511-001)	Pollock
ST 515 Experimental Statistics for Engineers	3
Prerequisite: ST 361 or Graduate standing	
0950-1120 (94-515-001)	Bloomfield
ST 591 Special Problems	1-3
Hours arranged (94-591-001)	Staff
ST 691 Advanced Special Problems	1-3
Prerequisites: ST 552; ST 402 or equivalent	
Hours arranged (94-691-001)	Staff
ST 699 Research	Credits Arranged
Hours arranged (94-699-001)	Staff

SECOND SESSION

ST 372 Introduction to Statistical Inference and Regression	3
Prerequisite: ST 371	
0950-1120 (94-372-001)	Manson
\$ ST 512S Experimental Statistics II	3
Prerequisite: ST 511 or equivalent	
0800-0930 (94-512-001)	Hamann
\$ ST 516 Experimental Statistics for Engineers	3
Prerequisite: ST 361 or Graduate standing	
0950-1120 (94-516-001)	Hader
ST 591 Special Problems	1-3
Hours arranged (94-591-001)	Staff
ST 691 Advanced Special Problems	1-3
Prerequisites: ST 552; ST 402 or equivalent	
Hours arranged (94-691-001)	Staff
ST 699 Research	Credits Arranged
Hours arranged (94-699-001)	Staff

TEN-WEEK SESSION

ST 595 Statistical Consulting	1
Prerequisites: ST 512 and ST 522	
Hours arranged (94-595-051)	Staff

Social Work

FIRST SESSION

SW 498 Special Topics in Social Work	1-6
Prerequisite: Nine hours of Social Work. Social Work students only.	
Hours arranged (86-498-001)	Reid

SECOND SESSION

SW 498 Special Topics in Social Work	1-6
Prerequisite: Nine hours of Social Work. Social Work students only.	
Hours arranged (86-498-001)	Reid

Textile Chemistry

FIRST SESSION

T 203 Introduction to Polymer Chemistry	3
Prerequisite: CH 101	
0800-0930 (95-203-001)	Tomasino
TC 490 Special Topics in Textile Chemistry	1-6
Hours arranged (96-490-001)	Livengood
TC 591 Special Topics in Textile Science	1-4
Prerequisites: Senior or Graduate standing and Consent of Instructor	
Hours arranged (96-591-001)	Livengood
TC 699 Textile Research for Textile Chemistry	Credits Arranged
Hours arranged (96-699-001)	Livengood

SECOND SESSION

\$ T 301 Technology of Dyeing and Finishing	4
Prerequisite: T 203	
LR 0950-1120 (95-301-001)	B. Smith
LB 1340-1620 MW (95-301-101)	
T 493 Industrial Internship in Textiles	3
Prerequisite: Textile Core Courses. Limited to 3 hours as Free Elective.	
Hours arranged (95-493-001)	Massey
TC 490 Special Topics in Textile Chemistry	1-6
Hours arranged (95-490-001)	Livengood
TC 591 Special Topics in Textile Science	1-4
Prerequisites: Senior or Graduate standing and Consent of Instructor	
Hours arranged (96-591-001)	Livengood
TC 699 Textile Research for Textile Chemistry	Credits Arranged
Hours arranged (96-699-001)	Livengood

Textile Management and Technology

FIRST SESSION

\$ T 220 Yarn Production Systems	3
Prerequisites: T 105, MA 111	
LR 0950-1050 (95-220-001)	Banks-Lee
LB 1340-1620 TuTh (95-220-101)	
TX 490 Development Project in Textile Technology	2-3
Prerequisites: Senior standing and 2.75 GPA	
Hours arranged (97-490-001)	Hutchison
TX 590 Special Projects in Textiles	2-3
Prerequisites: Senior or Graduate standing and Consent of Instructor	
Hours arranged (97-590-001)	Gupta
\$ TX 621 Advanced Textile Testing	3
Prerequisites: TX 530; ST 421 or Consent of Instructor	
LR 0910-1010 (97-621-001)	Stuckey
LB 1340-1620 TuTh (97-621-101)	
TX 697 Independent Study in Textiles	3
Hours arranged (97-697-001)	Gupta
TX 699 Textile Thesis or Dissertation Research	Credits Arranged
Hours arranged (97-699-001)	Gupta

SECOND SESSION

\$ T 105 Introduction to Textile Material Science	3
LR 0950-1050 (95-105-001)	Buchanan
PR 1340-1620 MW (95-105-201)	
\$ T 250 Textile Fabrics: Formation and Structure	3
Prerequisites: T 105 and MA 111	
LR 0800-0900 (95-250-001)	Donaldson
LB 1340-1620 TuTh (95-250-101)	
T 493 Industrial Internship in Textiles	3
Prerequisite: Textile Core courses. Limited to 3 hours as Free Elective.	
Hours arranged (95-493-001)	Massey

TX 490 Development Project in Textile Technology	2-3
Prerequisites: Senior standing and 2.75 GPA	
Hours arranged (97-490-001)	Hutchison
TX 590 Special Projects in Textiles	2-3
Prerequisites: Senior or Graduate standing and Consent of Instructor	
Hours arranged (97-590-001)	Gupta
TX 697 Independent Study in Textiles	3
Hours arranged (97-697-001)	Gupta
TX 699 Textile Thesis or Dissertation Research	Credits Arranged
Hours arranged (97-699-001)	Gupta

Toxicology

FIRST SESSION

TOX 590 Special Problems in Toxicology	1-3
Prerequisite: Graduate standing	
Hours arranged (88-590-001)	Staff
TOX 699 Research	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (88-699-001)	Staff

SECOND SESSION

TOX 590 Special Problems in Toxicology	1-3
Prerequisite: Graduate standing	
Hours arranged (88-590-001)	Staff
TOX 699 Research	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (88-699-001)	Staff

University Studies

FIRST SESSION

UNI 301 Science and Civilization	3
Prerequisite: Sophomore standing	
0800-0930 (89-301-001)	Stalnaker
0950-1120 (89-301-002)	Stalnaker
UNI 302 Contemporary Science and Human Values	3
Prerequisite: Sophomore standing	
0800-0930 (89-302-001)	Korte
0950-1120 (89-302-002)	Korte

SECOND SESSION

UNI 301 Science and Civilization	3
Prerequisite: Sophomore standing	
0950-1120 (89-301-001)	Hoffman
1140-1310 (89-301-002)	Hoffman

Visual Design

FIRST SESSION

\$ VD 400 Intermediate Visual Design (Series)	6
Prerequisite: DF 102	
0750-1300 (42-400-001)	Ater

VD 595 Independent Study in Visual Design	1-3
Hours arranged (42-595-001)	Foote

VD 691 Special Topics in Visual Design	1-6
Prerequisite: Permission of Graduate advisor	
Hours arranged (42-691-001)	Foote

SECOND SESSION

VD 595 Independent Study	1-3
Hours arranged (42-595-001)	Staff

VD 691 Special Topics in Visual Design	1-6
Prerequisite: Permission of Graduate advisor	
Hours arranged (42-691-001)	Foote

Veterinary Medical Sciences

FIRST SESSION

VMS 590 Special Topics in Veterinary Medical Sciences	1-3
Prerequisite: Senior or Graduate standing	
Hours arranged (84-590-001)	Bentley/Berkhoff/Brown/Henrikson

VMS 690B Special Topics in Pathology	1-4
Prerequisite: DVM degree and Consent of Instructor	
Hours arranged (84-690-001)	Brown/Staff

VMS 690C Special Topics in Laboratory Pharmacology	1-3
Prerequisite: Graduate standing and Consent of Instructor	
Hours arranged (84-690-002)	Bentley/Staff

VMS 694A Seminar in Necropsy Pathology	1
Prerequisites: DVM or equivalent degree and Consent of Instructor	
Hours arranged (84-694-001)	Brown/Staff

VMS 694B Seminar in Surgical Pathology	1
Prerequisites: DVM or equivalent degree and Consent of Instructor	
Hours arranged (84-694-002)	Brown/Staff

VMS 699 Research in Veterinary Medical Sciences	1-3
Prerequisite: Graduate standing	
Hours arranged (84-699-001)	Bentley/Berkhoff/Brown/Henrikson

SECOND SESSION

VMS 590 Special Topics in Veterinary Medical Sciences	1-3
Prerequisite: Senior or Graduate standing	
Hours arranged (84-590-001)	Bentley/Berkhoff/Brown/Henrikson

VMS 690B Special Topics in Pathology	1-4
Prerequisites: DVM degree and Consent of Instructor	
Hours arranged (84-690-001)	Brown/Staff

VMS 690C Special Topics in Laboratory Pharmacology	1-3
Prerequisites: Graduate standing and Consent of Instructor	
Hours arranged (84-690-002)	Bentley/Staff

VMS 694A Seminar in Necropsy Pathology	1
Prerequisites: DVM or equivalent degree and Consent of Instructor	
Hours arranged (84-694-001)	Brown/Staff

VMS 694B Seminar in Surgical Pathology	1
Prerequisites: DVM or equivalent degree and Consent of Instructor	
Hours arranged (84-694-002)	Brown/Staff

VMS 699 Research in Veterinary Medical Sciences	1-3
Prerequisite: Graduate standing	
Hours arranged (84-699-001)	Bentley/Berkhoff/Brown/Henrikson

Wood and Paper Science

FIRST SESSION

\$ WPS 205 Wood Products Practicum	5
WST Summer Practicum	
Prerequisite: WPS 201 or WPS 202	
0800-1700 (90-205-001)	Gilmore/Kelly
May 12-June 13—Five-Week Course—Final Exam June 13	
WPS 210 Forest Products Internship	1
Prerequisite: Completion of Summer Practicum	
0800-1700 (90-210-001)	Kelly
\$ WPS 491 Senior Problems in Wood and Paper Science	1-4
Prerequisite: Consent of Department	
Hours arranged (90-491-001)	Staff
WPS 591 Wood and Paper Science Problems	Credits Arranged
Prerequisite: Senior or Graduate standing	
Hours arranged (90-591-001)	Staff
WPS 693 Advanced Wood and Paper Science Problems	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (90-693-001)	Staff
WPS 699 Problems and Research	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (90-699-001)	Staff

SECOND SESSION

\$ WPS 491 Senior Problems in Wood and Paper Science	1-4
Prerequisite: Consent of Department	
Hours arranged (90-491-001)	Staff
WPS 591 Wood and Paper Science Problems	Credits Arranged
Prerequisite: Senior or Graduate standing	
Hours arranged (90-591-001)	Staff
WPS 693 Advanced Wood and Paper Science Problems	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (90-693-001)	Staff
WPS 699 Problems and Research	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (90-699-001)	Staff

Zoology

FIRST SESSION

\$ BS 100 General Biology	4
(See Biological Sciences)	
\$ ZO 201 General Zoology	4
Prerequisite: BS 100 or BS 105	
LR 0800-0930 (99-201-001)	Stuart
LB 1340-1750 MW (99-201-101)	
LB 1340-1750 TuTh (99-201-102)	

\$ ZO 212 Basic Anatomy and Physiology	4
Prerequisite: BS 100 (only free elective credit will be allowed for students majoring in Biological Sciences, Zoology, Conservation or Wildlife Biology).	
LR 0950-1120 (99-212-001)	Grimes
LB 1340-1750 MW (99-212-101)	
ZO (FW) 221 Conservation of Natural Resources	3
(See Fisheries and Wildlife)	
\$ ZO (BO) 360 Introduction to Ecology	4
Prerequisite: A 200 level Biology course	
LR 0950-1120 (99-360-001)	Staff
LB 1340-1750 MW (99-360-101)	
LB 1340-1750 TuTh (99-360-102)	
\$ ZO (ENT) 425 General Entomology	3
(See Entomology)	
ZO 590 Special Studies	Credits Arranged
Prerequisites: Twelve hours in Zoology and Consent of Instructor	
Hours arranged (99-590-001)	G. C. Miller
ZO 699 Research in Zoology	Credits Arranged
Prerequisites: Twelve hours in Zoology and Consent of Instructor	
Hours arranged (99-699-001)	G. C. Miller
SECOND SESSION	
\$ ZO 303 Vertebrate Zoology	4
Prerequisite: BS 100 or BO 200	
LR 0950-1120 (99-303-001)	Zielinski
LB 1340-1750 MW (99-303-101)	
LB 1340-1750 TuTh (99-303-102)	
ZO 421 Vertebrate Physiology	3
Prerequisites: CH 223, PY 212, ZO 201 or ZO 303	
1910-2200 MTuWTh (99-421-001)	Grimes
ZO 590 Special Studies	Credits Arranged
Prerequisites: Twelve hours in Zoology and Consent of Instructor	
Hours arranged (99-590-001)	G. C. Miller
ZO 699 Research in Zoology	Credits Arranged
Prerequisites: Twelve hours in Zoology and Consent of Instructor	
Hours arranged (99-699-001)	G. C. Miller



SUMMER SESSIONS FACULTY

A

Charlie Frank Abrams, Jr., Ph.D., Professor, Biological and Agricultural Engineering
 D. A. Adams, Ph.D., Associate Professor, Forestry and University Studies
 Elsayed M. Afify, Ph.D., Professor, Mechanical and Aerospace Engineering
 Ruth Alder, Ph.D., Associate Professor, Foreign Languages and Literatures
 Susan Lieberman Allen, M.S., Instructor, Zoology
 Sally V. Almekinders, M.Ed., Lecturer, Physical Education
 Sylvia Alonso, Ph.D., Associate Professor, Foreign Languages and Literatures
 Norman D. Anderson, Ph.D., Professor, Mathematics and Science Education
 Ruth D. Anderson, Ph.D., Associate Professor, Speech-Communication
 Frank B. Armstrong, Ph.D., Professor, Biochemistry
 John F. Arnold, Ph.D., Associate Professor, Curriculum and Instruction
 Steven K. Ater, M.F.A., Assistant Professor, Design
 Lyn C. Aubrecht, Ph.D., Adjunct Assistant Professor, Curriculum and Instruction
 Leonard William Aurand, Ph.D., Professor, Food Science
 David Franklin Austin, Ph.D., Assistant Professor, Philosophy and Religion

B

Lynne E. Baker-Ward, Ph.D., Assistant Professor, Psychology
 David Ball, Ph.D., Associate Professor, Economics and Business
 Hershell Ray Ball, Jr., Ph.D., Associate Professor, Food Science
 Pam Banks-Lee, M.S., Instructor, Textiles
 Gwen Louise Barclay, M.A., Visiting Lecturer, English
 James C. Barker, Ph.D., Professor, Biological and Agricultural Engineering
 George O. Batton, B.S., Lecturer, Mechanical and Aerospace Engineering
 Hazel Marie Batts, M.A., Lecturer, Mathematics
 Gerald Robert Baughman, Ph.D., Associate Professor, Biological and Agricultural Engineering
 David Baumer, Ph.D., Assistant Professor, Economics and Business
 R. L. Beckman, Ph.D., Associate Professor, Botany
 William H. Beezley, Ph.D., Professor, History
 Ray Braman Benson, Ph.D., Professor, Materials Engineering
 Peter J. Bentley, Ph.D., Professor, Veterinary Sciences
 Herman J. Berkhoff, Ph.D., Professor, Veterinary Sciences
 A. Lynn Berle, M.Ed., Assistant Professor, Physical Education
 Richard H. Bernhardt, Ph.D., Professor, Industrial Engineering
 Leonidas Judd Betts, Ed.D., Associate Professor, English
 Michael G. Bevis, Ph.D., Assistant Professor, Marine, Earth and Atmospheric Sciences
 William L. Bingham, Ph.D., Associate Professor, Civil Engineering
 Paul Edward Bishop, Ph.D., Associate Professor, Microbiology
 George H. Blessis, M.E., Associate Professor, Civil Engineering
 Milton Clay Bliss, M.A., Assistant Director, Music
 Peter Bloomfield, Ph.D., Professor, Statistics
 George B. Blum, Jr., M.A.E., Professor, Biological and Agricultural Engineering
 Michael A. Boles, Ph.D., Associate Professor, Mechanical and Aerospace Engineering
 E. J. Boone, Ph.D., Professor, Adult and Community College Education
 Henry Dittimus Bowen, Ph.D., Professor, Biological and Agricultural Engineering
 Albert S. Boyers, M.S., Lecturer, Mechanical and Aerospace Engineering
 R. R. Braham, Ph.D., Assistant Professor, Forestry
 Paul Arnold Bredenberg, Ph.D., Professor, Philosophy and Religion
 Robert C. Brisson, Ph.D., Associate Professor, Sociology and Anthropology
 Jack H. Britt, Ph.D., Professor, Animal Science
 Eugene Brooks, Ph.D., Lecturer, Economics and Business
 Joel V. Brothers, M.A.T., Assistant Professor, Physical Education
 H. Larry Brown, M.S., Assistant Professor, Physical Education
 Henry S. Brown, Ph.D., Professor, Marine, Earth and Atmospheric Sciences
 Talmage T. Brown, Jr., Ph.D., Professor, Veterinary Sciences
 Thomas H. Brown, M.S., Visiting Instructor, Mechanical and Aerospace Engineering
 William S. Bryan, MWPS, Research Assistant and Teaching Technician, Wood and Paper Science
 Bruce Bublitz, Ph.D., Assistant Professor, Economics and Business
 David R. Buchanan, Ph.D., Professor, Textiles Engineering and Science
 Sally B. Buckner, Ph.D., Visiting Assistant Professor, Curriculum and Instruction
 Carl L. Bumgardner, Ph.D., Professor, Chemistry
 Kathryn Ann Burak, M.F.A., Visiting Lecturer, English
 Robert P. Burns, M.A.R.C., Professor, Design

C

L. Raymond Camp, Ph.D., Associate Professor, Speech-Communication
 Dale Campbell, Ph.D., Assistant Professor, Adult and Community College Education

Roy Eugene Carawan, Ph.D., Extension Associate Professor, Food Science
 Charles H. Carlton, Ph.D., Professor, History
 Halbert H. Carmichael, Ph.D., Professor, Chemistry
 Ernest Carraway, J.D., Lecturer, Economics and Business
 Daniel Edward Carroll, Ph.D., Professor, Food Science
 William Randolph Carter, Ph.D., Professor, Philosophy and Religion
 George Lewis Catignani, Ph.D., Associate Professor, Food Science
 Thomas C. Caves, Ph.D., Associate Professor, Chemistry
 Richard Edward Chandler, Ph.D., Professor, Mathematics
 A. C. Chao, Ph.D., Associate Professor, Civil Engineering
 Harvey Johnson Charlton, Ph.D., Assistant Professor, Mathematics
 Shanna M. Chastain, M.A., Assistant Professor, Physical Education
 Mei-Lung Chen, Ph.D., Visiting Assistant Professor, Industrial Engineering
 Moody Chu, Ph.D., Assistant Professor, Mathematics
 Lung Ock Chung, Ph.D., Associate Professor, Mathematics
 Edward Depriest Clark, Ph.D., Associate Professor, English
 G. C. Cobb, Ph.D., Associate Professor, Physics
 Paul Rodman Cockshutt, A.B., Lecturer, English
 Charles K. Coe, D.P.A., Assistant Professor, Political Science and Public Administration
 Janice C. Coffey, Ph.D., Visiting Associate Professor, Biological Sciences
 R. N. Collender, Ph.D., Assistant Professor, Economics and Business
 Rosa Colquitt, Ed.D., Assistant Professor, Adult and Community College Education
 Russell C. Combs, M.S., Assistant Professor, Physical Education
 A. W. Cooper, Ph.D., Professor, Forestry
 Nelson E. Cooper, M.E., Associate Professor, Physical Education
 Alonzo F. Coots, Ph.D., Associate Professor, Chemistry
 Richard H. Cornell, Ph.D., Associate Professor, Wood and Paper Science
 Dario Cortes, Ph.D., Associate Professor, Foreign Languages and Literatures
 Marsha Courchane, Ph.D., Assistant Professor, Economics and Business
 David Harrison Covington, Ph.D., Assistant Professor, English
 James E. Crisp, Ph.D., Assistant Professor, History
 J. L. Crow, Ed.D., Assistant Professor, Occupational Education
 Joseph W. Cunningham, Ph.D., Professor, Psychology

D

Mark Anthony Daeschel, Ph.D., Assistant Professor, Food Science
 Philip Dail, M.Ed., Visiting Instructor, Chemistry
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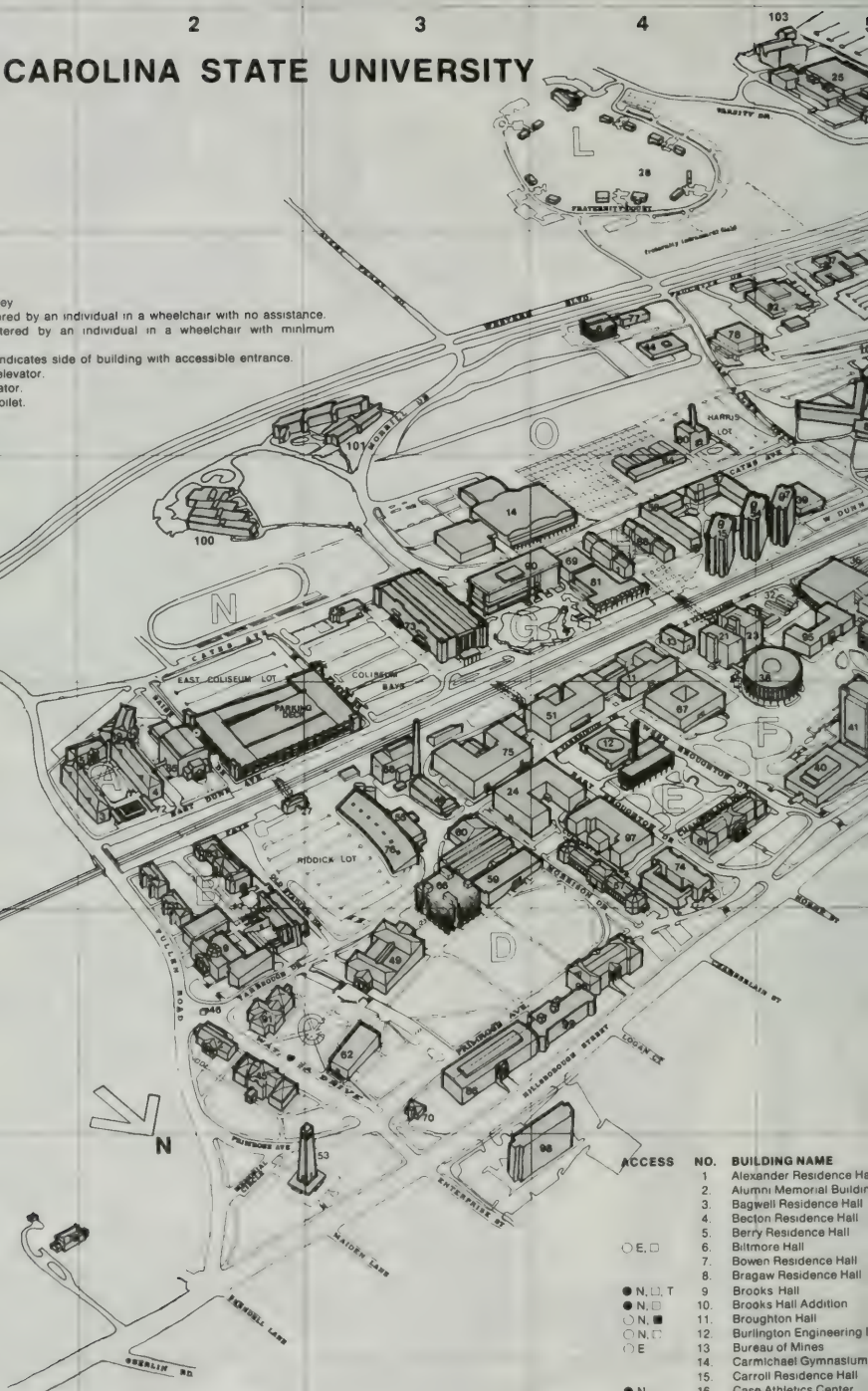
- can be entered by an individual in a wheelchair with no assistance.
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N, S, E, W,—indicates side of building with accessible entrance.

□ passenger elevator.

■ freight elevator

T accessible toilet.



ACCESS	NO.	BUILDING NAME
	1	Alexander Residence Hall
	2	Alumni Memorial Building
	3	Bagwell Residence Hall
	4	Becton Residence Hall
<input type="checkbox"/> E <input type="checkbox"/>	5	Berry Residence Hall
	6	Biltmore Hall
	7	Bowen Residence Hall
	8	Bragaw Residence Hall
<input checked="" type="radio"/> N <input type="radio"/> L <input type="radio"/> T	9	Brooks Hall
<input type="radio"/> N <input checked="" type="radio"/> B	10	Brooks Hall Addition
<input type="radio"/> N <input type="radio"/> C	11	Broughton Hall
<input type="radio"/> E	12	Burlington Engineering Hall
	13	Bureau of Mines
	14	Carmichael Gymnasium
	15	Carroll Residence Hall
<input checked="" type="radio"/> N	16	Case Athletics Center
	17	Central Stores
	18	Chancellor's Residence



ACCESS	NO.	BUILDING NAME	GRID	CODE
● W, □, T	19.	Clark Hall Infirmary	2-C	
○ S, ■	20	Clark Laboratories		CL
○ N, □	21.	Cox Hall	4-D	COX
○ N, T	22.	Cultural Center	5-D	
○ N, □	23	Dabney Hall	4-D	DAB
● W, ■	24	Danels Hall	4-C	DAN
● W, □, T	25.	McKimmion Extension Continuing Education Center	5-F	
	26	Farm Unit 5	6-F	
○ N	27.	Field House	2-C	
	28.	Fraternity Court	4-F	
○ S, ■	29	Gardner Hall	5-D	GA
● N, □, T	30.	Bostan Hall	2-C	
	31.	Gold Residence Hall	5-D	
	32	Greenhouse—Agronomy	5-D	AGH
	33	Greenhouse—Biological Sciences	5-D	BSG
	34	Greenhouse—Horticulture	5-D	HGH
	35	Greenhouse—840 Method Rd.	8-F	
	36	Greenhouse—Plant Pathology	6-D	PPG
○ E	37.	Ginnells Animal Health Lab	5-E	GHL
○ N, □, T	38	Harrelson Hall	5-D	HA
● N, □, T	39	Harris Hall	5-D	
○ W, □	40	D. H. Hill Library—Original Wing	5-C	DHL
○ W, □, T	41.	D. H. Hill Library—Book Stack Tower	5-C	
○ N, S, □	42	D. H. Hill Library—Erdahl-Cloyd Wing	5-C	
		North Campus Bookshop	5-C	
● N, □, T	43.	Hillsborough Building	5-C	HLB
○ W	44	Hodges Wood Products Lab	4-E	HWP
	45	Holladay Hall	2-B	
	46	Information Center, Visitor Parking	2-B	
○ S, ■	47	Kilgore Hall	6-D	KI
	48	Laundry	3-C	
	49	Leazar Hall	3-B	LEZ
	50.	Lee Residence Hall	5-E	
● S, □	51	Mann Hall	4-C	MN
	52	E. S. King Village (17 Apt. Bldgs. A-Q)	7-F	
	53.	Memorial Tower	3-A	
	54	Metcall Residence Hall	4-D	
● S	55	Morris Building	3-C	

ACCESS	NO.	BUILDING NAME	GRID	CODE
○ E, ■	56.	Nelson Textile Building	6-D	N
	57.	1911 Building	4-C	
	58.	Owen Residence Hall	4-D	
○ E	59.	Page Hall	3-C	PA
○ W	60.	Park Shops	3-C	PS
○ S	61.	Patterson Hall	4-C	PT
● E	62.	Peele Hall	3-B	
	63.	Physical Plant Maint. Center	7-E	
	64.	Physical Plant Shops (Armory)	4-D	
○ E	65.	Phytotron	5-D	PHY
○ E, □	66.	Poe Hall	3-C	POE
● N, □	67.	Polk Hall	4-C	PK
	68.	Power Plant	3-C	
○ S	69.	Price Music Center	4-D	PMC
● W, T	70.	Primrose Hall	3-B	
	71.	Print Shop/University Graphics	6-E	
● E	72.	Quad. Snack Bar	2-C	
○ E, T	73.	Wm. Neal Reynolds Coliseum	3-D	
○ E, □	74.	Ricks Hall	4-C	
○ N, ■	75.	Riddick Engineering Labs	3-C	
	76.	Riddick Stadium	3-C	
○ E	77.	Robertson Wing, Biltmore Hall	4-E	
○ S, □	78.	Schaub Food Science Building	4-E	SFS
○ S, ■	79.	Scott Hall	5-D	SC
	80.	Steam Plant	4-E	
○ E, ■	81.	Students Supply Stores	4-D	
	82.	Sullivan Residence Hall	6-E	
	83.	Syme Residence Hall	2-C	
	84.	Television Center	5-F	TVS
○ E	85.	Thompson Theatre/Craft Center	2-C	TT
○ N, S	86.	Tompkins Hall	3-B	
	87.	Tucker Residence Hall	4-D	
	88.	Turlington Residence Hall	4-D	
	89.	Turner House	6-C	
○ S, □, T	90.	University Student Center	3-D	USC
○ W, ■	91.	Watauga Hall	2-B	
	92.	Weaver Laboratories	5-E	DSW
	93.	Weed Control Laboratories	8-F	
	94.	Welch Residence Hall	2-C	
○ S, ■	95.	Williams Hall	5-D	WMS
○ N, S	96.	Winston Hall	4-B	WN
○ E, ■	97.	Withers Hall	4-C	WI
○ E, □	98.	North Residence Hall	3-A	
● S, □, T	99	Link	4-B	
● S, T	100	Weisiger-Brown Athl. Facility	2-B	
● E, □, T	101	Residence Hall (in construction)	3-D	
● E, T	102	Dining Hall	5-E	
● N, T	103	Solar Demonstration House	5-F	

	COURTS AND FIELDS	GRID
A.	Bagwell-Becton-Berry Quad	2-C
B.	Gold-Welch-Syme-Brooks Court	2-C
C.	Holladay Hall Court	3-B
D.	Court of North Carolina	3-B
E.	Gardner Arboretum	4-C
F.	University Plaza (Brickyard)	5-C
G.	University Student Center Plaza	4-D
H.	Turlington-Alexander Court	4-D
J.	Tucker-Owen Court	4-D
K.	Lee-Sullivan-Bragaw Court	5-E
L.	Fraternity Court	4-F
M.	E. S. King Village Court	7-F
N.	Paul H. Darr Track	2-D
O.	Miller Fields	4-E
P.	Doak Field	6-E
Q.	McKimmion Center Court	5-F
R.	The Big Acre	8-F

	PARKING LOTS	GRID
	Brooks Ave. Lot	6-C
	Carmichael Lot	3-D
	Coliseum Bays	3-D
	East Coliseum Lot	2-C
	Friendly Drive Lot	6-D
	Harris Lot	4-E
	Hillsborough Building Lots	6-C
	Parking Deck	2-C
	Riddick Lot	3-C
	Sullivan Lots	6-E
	West Lot	6-E
	Additional West Lot Parking	6-E
	Yarbrough Lot	3-C







**North Carolina State University
Box 7401
Raleigh, N. C. 27695-7401**

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BULLETIN

**North Carolina State University
1986-1988 Graduate Catalog**



Prominent in the above aerial of the central North Carolina State University campus are three high-rise residence halls (foreground), the circular Harrelson Hall with the adjacent towers of Cox and Dabney Halls, and in the upper left, the tower of the D. H. Hill Library. The central campus encompasses some 623 acres.

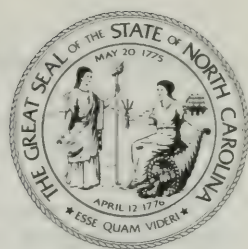
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North Carolina State University
Raleigh, North Carolina

Graduate Catalog
1986-88

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ADMINISTRATION

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Jasper D. Memory, *Vice Provost and Dean of Graduate School (on leave)*
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Dame S. Hamby, *Textiles*
Terrence M. Curtin, *Veterinary Medicine*

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R. E. Fornes, *Acting Dean*
D. W. Stewart, *Acting Dean*
A. M. Witherspoon, *Acting Dean*

Graduate School—Administrative Board

	<i>Term Expires</i>
J. D. Memory, <i>Dean (on leave)</i>	
R. E. Fornes, <i>Acting Dean</i>	
D. W. Stewart, <i>Acting Dean</i>	
A. M. Witherspoon, <i>Acting Dean</i>	
R. D. Bereman, <i>Professor of Chemistry; Associate Dean for Academic Affairs, School of Physical and Mathematical Sciences</i>	June, 1986
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E. B. Cowling, <i>Professor of Forestry, Plant Pathology and Wood and Paper Science; Associate Dean for Research, School of Forest Resources</i>	June, 1987
C. L. Crossland, <i>Associate Professor of Curriculum and Instruction</i>	June, 1987

D. W. Dalton, <i>Assistant Professor of Landscape Architecture</i>	May, 1987
S. E. Elmaghraby, <i>University Professor of Industrial Engineering and Operations Research; Director of the Operations Research Program</i>	December, 1989
E. S. Fairchild, <i>Associate Professor of Political Science and Public Administration; Director and Graduate Administrator of Public Affairs Program</i>	February, 1988
J. K. Ferrell, <i>Alcoa Professor of Chemical Engineering; Director of Graduate Programs, School of Engineering</i>	June, 1986
H. R. Horton, <i>William Neal Reynolds Professor of Biochemistry</i>	June, 1987
B. H. Johnson, <i>Professor of Animal Science and Graduate Administrator</i>	November, 1989
D. G. Simmons, <i>Professor of Veterinary Medicine, Microbiology and Poultry Science</i>	April, 1988
O. Wesler, <i>Professor of Statistics and Mathematics</i>	March, 1987

THE CALENDAR

FALL SEMESTER, 1985

August 23	Fri.	Registration/change day (late registration, drop/add).
August 26	Mon.	First day of classes.
September 2	Mon.	Holiday.
September 9	Mon.	Last day to add a course; last day to withdraw or drop a course with a refund.
September 23	Mon.	Last day to drop a course at the 400 level or below without a grade.
October 4	Fri.	Mid-semester reports due.
October 11	Fri.	Fall vacation begins at 10:00 p.m.
October 16	Wed.	Classes resume at 7:50 a.m.
October 25	Fri.	Last day to drop a course at the 500 or 600 level without a grade.
November 8	Fri.	<i>Deadline for submission of theses to the Graduate School in final form as approved by advisory committees by candidates for master's and doctoral degrees in December, 1985. Last day for unconditional pass on final oral examinations by candidates for master's degrees not requiring theses.</i>
November 27	Wed.	Thanksgiving vacation begins at 1:00 p.m.
November 28	Mon.	Classes resume at 7:50 a.m.
December 6	Fri.	Last day of classes.
December 9-17	Mon.-Tues.	Final examinations.

SPRING SEMESTER, 1986

January 7	Tues.	Registration/change day (late registration, drop/add).
January 9	Thur.	First day of classes.
January 22	Wed.	Last day to add a course; last day to withdraw or drop a course with a refund.
February 5	Wed.	Last day to drop a course at the 400 level or below without a grade.
February 19	Wed.	Mid-semester reports due.
February 28	Fri.	Spring vacation begins at 10:00 p.m.
March 10	Mon.	Classes resume at 7:50 a.m.
March 14	Fri.	Last day to drop a course at the 500 or 600 level without a grade.
March 28	Fri.	<i>Deadline for submission of theses to the Graduate School in final form as approved by advisory committees by candidates for master's and doctoral degrees in May, 1986. Last day for unconditional pass on final oral examina-</i>

		<i>tions by candidates for master's degrees not requiring theses.</i>
March 31	Mon.	Holiday.
April 25	Fri.	Last day of classes.
April 28-May 6	Mon.-Tues.	Final examinations.
May 10	Sat.	Commencement.

SUMMER SESSIONS, 1986

First Session

May 19	Mon.	Registration/change day.
May 20	Tues.	First day of classes.
May 26	Mon.	Last day to add a course; last day to withdraw or drop a course with a refund.
May 30	Fri.	Last day to drop a course at the 400 level or below without a grade.
June 6	Fri.	Last day to drop a course at the 500 or 600 level without a grade.
June 23	Mon.	Last day of classes.
June 24-25	Tues.-Wed.	Final examinations.

Second Session

June 30	Mon.	Registration/change day.
July 1	Tues.	First day of classes.
July 4	Fri.	Holiday.
July 7	Mon.	Last day to add a course; last day to withdraw or drop a course with a refund.
July 8	Tues.	<i>Deadline for submission of theses to the Graduate School in final form as approved by advisory committees by candidates for master's and doctoral degrees in August, 1986. Last day for unconditional pass on final oral examinations by candidates for master's degrees not requiring theses.</i>
July 11	Fri.	Last day to drop a course at the 400 level or below without a grade.
July 18	Fri.	Last day to drop a course at the 500 or 600 level without a grade.
August 5	Tues.	Last day of classes.
August 6-7	Wed-Thurs.	Final examinations.

FALL SEMESTER, 1986

August 22	Fri.	Registration/change day (late registration, drop/add).
August 25	Mon.	First day of classes.
September 1	Mon.	Holiday.

September 8	Mon.	Last day to add a course; last day to withdraw or drop a course with a refund.
September 22	Mon.	Last day to drop a course at the 400 level or below without a grade.
October 3	Fri.	Mid-semester reports due.
October 10	Fri.	Fall vacation begins at 10:00 p.m.
October 15	Wed.	Classes resume at 7:50 a.m.
October 24	Fri.	Last day to drop a course at the 500 or 600 level without a grade.
November 7	Fri.	<i>Deadline for submission of theses to the Graduate School in final form as approved by advisory committees by candidates for master's and doctoral degrees in December, 1986. Last day for unconditional pass on final oral examinations by candidates for master's degrees not requiring theses.</i>
November 26	Wed.	Thanksgiving vacation begins at 1:00 p.m.
December 1	Mon.	Classes resume at 7:50 a.m.
December 5	Fri.	Last day of classes.
December 8-16	Mon.-Tues.	Final examinations.

SPRING SEMESTER, 1987

January 6	Tues.	Registration/change day (late registration, drop/add).
January 8	Thurs.	First day of classes.
January 14	Wed.	Last day to add a course; last day to withdraw or drop a course with a refund.
February 4	Wed.	Last day to drop a course at the 400 level or below without a grade.
February 18	Wed.	Mid-semester reports due.
February 27	Fri.	Spring vacation begins at 10:00 p.m.
March 9	Mon.	Classes resume at 7:50 a.m.
March 13	Fri.	Last day to drop a course at the 500 or 600 level without a grade.
March 27	Fri.	<i>Deadline for submission of theses to the Graduate School in final form as approved by advisory committees by candidates for master's and doctoral degrees in May, 1987. Last day for unconditional pass on final oral examinations by candidates for master's degrees not requiring theses.</i>
April 20	Mon.	Holiday.
April 24	Fri.	Last day of classes.
April 27-May 5	Mon.-Tues.	Final examinations.
May 9	Sat.	Commencement.

SUMMER SESSIONS, 1987*First Session*

May 19	Mon.	Registration/change day.
May 20	Tues.	First day of classes.
May 25	Mon.	Last day to add a course; last day to withdraw or drop a course with a refund.
May 29	Fri.	Last day to drop a course at the 400 level or below without a grade.
June 5	Fri.	Last day to drop a course at the 500 or 600 level without a grade.
June 22	Mon.	Last day of classes.
June 23-24	Tues.-Wed.	Final examinations.

Second Session

June 29	Mon.	Registration/change day.
June 30	Tues.	First day of classes.
July 6	Mon.	Last day to add a course; last day to withdraw or drop a course with a refund.
July 6	Mon.	<i>Deadline for submission of theses to the Graduate School in final form as approved by advisory committees by candidates for master's and doctoral degrees in August, 1987. Last day for unconditional pass on final oral examinations by candidates for master's degrees not requiring theses.</i>
July 10	Fri.	Last day to drop a course at the 400 level or below without a grade.
July 17	Fri.	Last day to drop a course at the 500 or 600 level without a grade.
August 3	Mon.	Last day of classes.
August 4-6	Tues.-Wed.	Final examinations.

FALL SEMESTER, 1987

August 21	Fri.	Registration/change day (late registration, drop/add).
August 24	Mon.	First day of classes.
September 7	Mon.	Holiday.
September 8	Tues.	Last day to add a course; last day to withdraw or drop a course with a refund.
September 21	Mon.	Last day to drop a course at the 400 level or below without a grade.
October 2	Fri.	Mid-semester reports due.
October 9	Fri.	Fall vacation begins at 10:00 p.m.
October 15	Wed.	Classes resume at 7:50 a.m.

October 23	Fri.	Last day to drop a course at the 500 or 600 level without a grade.
November 6	Fri.	<i>Deadline for submission of theses to the Graduate School in final form as approved by advisory committees by candidates for master's and doctoral degrees in December, 1987. Last day for unconditional pass on final oral examinations by candidates for master's degrees not requiring theses.</i>
November 25	Wed.	Thanksgiving vacation begins at 1:00 p.m.
November 30	Mon.	Classes resume at 7:50 a.m.
December 4	Fri.	Last day of classes.
December 7-15	Mon.-Tues.	Final examinations.

NOTE: This calendar is subject to periodic review and revision.





NORTH CAROLINA STATE UNIVERSITY

North Carolina State University is one of the nation's major public universities—large, complex, national and international in scope, and a leader in education and research. It ranks among the top universities in the nation and shares the distinctive character of Land-Grant state universities nationally—broad academic offerings, extensive public service, national and international activities, and large-scale extension and research programs.

North Carolina State University is committed to equality of educational opportunity and does not discriminate against applicants, students, or employees based on race, color, national origin, religion, sex, age or handicap. Moreover, N. C. State University is open to people of all races and actively seeks to promote racial integration by recruiting and enrolling a larger number of black students.

N. C. State's rich and varied academic program is comprised of 96 undergraduate degree programs spanning 89 fields of study, 105 master's degree programs spanning 75 fields of study, 48 doctoral degree programs and the doctor of veterinary medicine program. The University offers approximately 2,900 courses.

Research activities span a broad spectrum of about 700 scientific, technological and scholarly endeavors with a budget of more than \$80 million annually.

Extension organizations in each of the 100 counties in North Carolina and in the Cherokee Indian Reservation assist in carrying the University's teaching and applied research programs throughout the State. The diversity of these programs spans such fields as agriculture, design, education, engineering, forestry, humanities, marine sciences, textiles, urban affairs and veterinary medicine.

The annual University budget is more than \$300 million and it has approximately 5,600 employees. There are more than 2,700 faculty and professional staff, including 1,400 graduate faculty and 226 adjunct faculty.

There are 150 campus buildings on the central campus of 623 acres. In addition, the University has acquired an adjacent property of 780 acres which will allow expansion. It has some 88,000 acres on a statewide basis, including one research and endowment forest of 78,000 acres. Near the main campus are research farms; biology and ecology sites; genetics, horticulture and floriculture nurseries; forests and other areas such as Carter-Finley Stadium, which together comprise about 2,500 acres.

The University's total enrollment is more than 24,000 including approximately 16,900 undergraduate students, 3,350 graduate students, 3,300 lifelong education students and 500 students in other special categories. The total student population is made up of approximately 8,900 women and 15,100 men including 2,860 black or other minority students. Students come to N. C. State from nearly every state in the nation and at least 88 foreign countries are represented by the more than 800 international students.

The University is organized in nine schools and the Graduate School. The nine schools are Agriculture and Life Sciences, Design, Education, Engineering, Forest Resources, Humanities and Social Sciences, Physical and Mathematical Sciences, Textiles, and Veterinary Medicine. In addition, a complex of divisions and programs provides for a wide range of special programs in academic affairs, research and extension.

North Carolina State University is one of the three Research Triangle Universities along with Duke University and the University of North Carolina at Chapel Hill. In the 30-mile triangle formed by the three universities is the 5,500-acre Research Triangle Park; the Research Triangle Institute, a subsidiary of the three universities; and the Triangle Universities Computation Center, a central facility for the extensive computing centers of the institutions.

State is a member of the National Association of State Universities and Land-Grant Colleges. It is also a member of the American Council on Education, the College Entrance Examination Board, the Council of Graduate Schools in the United States, the National Commission on Accrediting, and the Southern Association of Colleges and Schools.

The University is accredited by national and regional accrediting agencies applicable to the University and its numerous professional fields.

THE GRADUATE SCHOOL

Graduate instruction was first offered at North Carolina State University in 1893, and the first doctoral degree was conferred in 1926. In the ensuing years, the Graduate School has grown steadily and now provides instruction and facilities for advanced study and research in the fields of agriculture and life sciences, design, education, engineering, forest resources, humanities and social sciences, physical and mathematical sciences, textiles and veterinary medicine. In 1984-85, the University granted 178 Doctor of Philosophy degrees, 26 Doctor of Education degrees and 594 master's degrees.

The Graduate School is currently composed of more than 1,400 graduate faculty members. Educated at major universities throughout the world and established both in advanced teaching and research, these scholars guide the University's 3,350 master's and doctoral students from all areas of the United States and some 88 other countries.

The faculty and students have available exceptional facilities, including libraries, laboratories, modern equipment and special research areas. Additionally, a cooperative agreement exists among the Graduate Schools of the University of North Carolina at Chapel Hill, the University of North Carolina at Greensboro, Duke University and North Carolina State University which increases the educational and research possibilities associated with each.

Graduate Student Association

The Graduate Student Association (GSA) is an academic, political and social organization composed of all graduate students and governed by duly elected officials and representatives from the departmental graduate student chapters. It is officially recognized by the university as the voice of the graduate students. The GSA President has full voting membership on the Graduate School Administrative Board and the GSA has the ability to broach responsible grievances to the administration on behalf of any graduate student.

Among the services that the GSA sponsors, one of its most viable academic programs is the Travel Fund. Through this fund graduate students may obtain funds to present original research work at professional meetings. The GSA also sponsors, along with the Alumni Association and the Academy of Outstanding Teachers, an annual awards ceremony to honor those teaching assistants of outstanding merit. In addition, the GSA, through its standing committees, sponsors various social events and provides support for departmental GSA chapters.

Generally, the GSA can provide assistance on most questions concerning graduate student life. Graduate students may contact GSA via their departmental representative or via the president of the Association whose telephone number can be obtained through the Graduate School. All graduate students are also invited to participate in the business meetings which are usually held on the fourth Monday of each month. Contact departmental representatives for time and place.

The D. H. Hill Library

Library facilities at North Carolina State University include the main D. H. Hill Library and special libraries for the Schools of Design, Textiles, Forest Resources and Veterinary Medicine as well as the Curriculum Materials Center in the School of Education. The collections, totaling more than 1,200,000 books and bound journals, 2,500,000 microforms, and 600,000 government publications, have been carefully assembled to serve the educational and research programs of the University.

The D. H. Hill Library contains particularly strong research holdings in the biological and physical sciences, in all fields of engineering, agriculture and forestry. The collection of books and journals in the humanities and social sciences is especially strong in English and American literature, sociology and economics.

The library's comprehensive collection of journals emphasizes the major teaching and research interests at State; approximately 8,500 journals are received regularly. A large collection of state and federal government publications further strengthens the library's research holdings. The D. H. Hill Library has been a depository for U. S. federal documents since 1924. The Library has a comprehensive collection of government research reports on microfiche including reports published by the Department of Energy (DOE) and its predecessor agencies, the Atomic Energy Commission (AEC) and the Energy Research and Development Administration (ERDA); also, the National Aeronautical and Space Administration (NASA), the Educational Resources Information Center (ERIC) and the National Technical Information Service (NTIS). The Library is an official U.S. Patent depository and has a complete collection of U.S. patents on microfilm from 1790 to date.

The Textiles Library, located in Nelson Textile Building, contains holdings in the fields of textiles and textile chemistry. It is regarded as one of the best textile libraries in the country. The School of Design Library, in Brooks Hall, has a fine collection of books, journals and slides in the areas of architecture, landscape architecture and product design. The Forest Resources Library, which contains a limited collection of specialized literature, is located in Biltmore Hall. The Veterinary Medical Library is a growing collection that serves the students and faculty of the School of Veterinary Medicine.

On-line computer-based literature searches are offered by the Library staff on over 60 data bases, including ERIC, BIOSIS, AGRICOLA (Bibliography of Agriculture) and Psychological Abstracts. Only direct costs are charged to the user.

As a further aid to graduate and faculty research, the library participates in an interlibrary loan program with the University of North Carolina at Chapel Hill, Duke University and all libraries in the Research Triangle. A truck, arriving at the University daily Monday through Friday, makes resources from these libraries available to State students and faculty.

Among the many services offered by the library are orientation tours for faculty and graduate students and also lectures on library use to all new students. Comprehensive reference service is available almost all the hours the library is open. A variety of microtext readers and printers in the library and an extensive microfilm collection provide access to much important research material. The Media Center is

equipped with audio and video equipment for group and individual viewing and listening. The Library has a growing collection of video and audio cassettes for individual and class use. One of the most widely used services in the library is the photocopy service. Coin-operated machines plus three machines operated by staff provide a wide variety of photocopy service, including copy from microfilm. Machines may be used all hours the library is open.

The Curriculum Materials Center, administered by the School of Education, is located in Poe Hall. The center maintains a collection of educational materials with particular emphasis on teaching methods, research, administration and psychology and includes films, filmstrips, slides, audio tapes, video cassettes and simulation games. A special collection of materials covering the areas of anthropology and third world countries is also maintained. Audiovisual equipment is available for previewing materials in the center and may be borrowed for use in Poe Hall classrooms. The center acquires each textbook adopted by the State Board of Education for secondary level subjects as well as other textbooks and reference materials.

Institutes

RESEARCH TRIANGLE

The unique "Research Triangle" in North Carolina has captured national and international attention since its establishment in 1975. It is a complex of three major universities and a research park. The Triangle area has since come to contain the highest total of Ph.D. scientists and engineers on a per capita basis in the nation. The Triangle Universities—NCSU, the University of North Carolina at Chapel Hill and Duke University—have a subsidiary campus in the Park—the Research Triangle Institute—which has an annual research revenue of approximately \$45 million.

There are over 45 additional public and industrial research organizations in the 6,200-acre park employing over 21,000 people. These include the permanent headquarters of the National Institute of Environmental Health Sciences, the Environmental Protection Agency and the National Center for the Humanities. Two major new research complexes for microelectronics and biotechnology have been established in the Park. Faculty and graduate students from the universities work closely with Park activities, and scientists there frequently hold adjunct appointments in one or another of the Triangle Universities.

INSTITUTE OF STATISTICS

The Institute of Statistics is composed of two sections, one at Raleigh and the other at Chapel Hill. At North Carolina State University, the Institute provides statistical consulting services to all branches of the institution, sponsors research in statistical theory and methodology and coordinates the teaching of statistics at the undergraduate and graduate levels. The instructional and other academic functions are performed by the Department of Statistics, which forms a part of the Institute.

WATER RESOURCES RESEARCH INSTITUTE

The Water Resources Research Institute is a unit of the University of North Carolina System and is located on the campus of North Carolina State University. The deans of the School of Engineering and School of Agriculture and Life Sciences, the Dean for Research at North Carolina State University and two faculty members from the University of North Carolina at Chapel Hill serve as a board of directors. The Institute was established to promote a multidisciplinary attack on water problems, to develop and support research in response to the needs of North Carolina, to encourage strengthened educational programs in water resources, to coordinate research and educational programs dealing with water resources and to provide a link between the state and federal water resources agencies and related interests in the University.

Research and educational activities are conducted through established departments and schools of the University System. All senior colleges and universities of North Carolina are eligible to participate in the Institute's research program. Basic support for the Institute's program is provided by the Office of Water Research and Technology, U.S. Department of the Interior, under the Water Research and Development Act of 1978 and appropriations from the State of North Carolina.

The Institute has sponsored a graduate minor in water resources which offers a strong water resources program with the major in any of the basic disciplines contributing to water resources planning, conservation, development and management. This capitalizes on the combined training resources of the Raleigh and Chapel Hill campuses of the University System and offers these in an organized way to graduate students seeking interdisciplinary training in this field. Additional information concerning the program is presented elsewhere in this catalog.

The Institute sponsors research and educational symposia and seminars, encourages the development of specialized training opportunities and provides a means for the continuing evaluation and strengthening of the University System's total water resources program.

Special Laboratories and Facilities

ACADEMIC COMPUTING FACILITIES

Centralized computing facilities for the University are located in the Hillsborough Building, in other campus buildings and at Triangle Universities Computation Center (TUCC) in the Research Triangle Park about fifteen miles from the campus. TUCC is owned by North Carolina State University, Duke University and the University of North Carolina at Chapel Hill and provides computing to over fifty research and educational institutions in North Carolina. Access to computing facilities at universities outside North Carolina is available to the University through TUCC via the Bitnet and Telenet Networks.

Computing at TUCC is supplied by an IBM System 3081 Model K24 with an attached Floating Point Systems Model 164 Scientific Processor and an IBM System 370 Model 168. The computer systems have main memories of 24, 16 and 8 megabytes, respectively, have a combined disk storage of over 30 gigabytes and a

variety of peripheral and communications equipment. Data are transmitted to and from TUCC via the University's Computer Communications System from many computing sites on the campus.

The main campus computing facility is an IBM 4341-M2 with eight million characters of memory providing interactive computing services for students. There is also an IBM 3083 providing administrative data processing services for the campus. These systems are located at the Computing Center in the Hillsborough Building. A high-speed computer terminal facility and computer-to-computer communication with TUCC is provided by the Computing Center. Medium-speed terminals are located in the Schools of Engineering and Agriculture and Life Sciences. Low-speed interactive terminals are located throughout the campus.

A number of special purpose computing facilities also exist. The Computer Graphics Center (CGC) provides a centralized hardware and software facility for image processing and remote sensing. Computers installed include a VAX 11/780, Charles River Systems and a number of microprocessors. Peripherals include image display and manipulation devices, plotters, printers, a color graphic camera system and digitizing tables. Software is composed of packages for remote sensing, image processing, time series analysis and computer graphics. Other facilities in most schools provide specialized educational and research computing for their students.

BIOLOGY FIELD LABORATORY

The Biology Field Laboratory is located eight miles from the University campus and comprises a 20-acre pond, 180 acres of extremely varied vegetation types and a modern laboratory building. The latter contains two laboratories, one for class use and another principally for research.

The many unique ecological situations found in this area make it ideal for use by advanced classes of most biological science departments. Likewise, the area is well adapted to a variety of research projects by faculty, graduate students and undergraduates because of its habitat diversity. The close proximity of the laboratory facility to the campus makes possible many types of behavioral, physiological, ecological, taxonomic and limnological studies that could be accomplished only with great difficulty at other locations.

CENTER FOR COMMUNICATIONS AND SIGNAL PROCESSING

North Carolina State University was selected as a site for an Industry/University Cooperative Research Center for Communications and Signal Processing. The National Science Foundation awarded the University a five-year grant totaling \$650,000 to be used in conjunction with company membership fees to begin operation of the Center. As of July, 1985, the Center had the following industrial members: Carolina Power and Light Company, Digital Equipment Corp., General Telephone and Electronics, Rockwell International, International Business Machines, International Telephone and Telegraph, Westinghouse Electric Corp., General Electric, Northern Telecom, FiberLAN, M/A-COM, Sperry Corp., United Telecommunication, Harris Corp., AT&T and Tellabs. The two objectives of the

Center are to conduct basic and applied research that can lead to products and services in the communications and signal processing fields and to strengthen industry/university relationships. In addition to providing useful research services to industrial participants, the Center will enhance the education of graduate students by providing them with practical, relevant research topics and the means for carrying out their research.

CENTER FOR ELECTRIC POWER RESEARCH

The Center for Electric Power Research is a university/industry cooperative research center recently established within the NCSU School of Engineering. The Center is funded by the University and sponsoring organizations from the various sectors of the electric utility and power industry. The purpose of the Center is to engage in collaborative efforts aimed at enhancing the excellence of research and graduate-level degree programs in electric power systems engineering. This primary purpose is accomplished by providing support for interested faculty and students to be involved in basic and applied research directly relevant to the needs of the multifaceted electric power industry. Motivation to work with the Center derives from the close university/industry interaction, the leverage afforded to an industrial sponsor's membership dues and the enhanced professional and research opportunities provided to faculty and students in electric power engineering.

While the current research program involves faculty from the Department of Electrical and Computer Engineering and the Department of Nuclear Engineering, the Center will facilitate access to all the various resources of the University and for all sectors of the electric power industry.

CENTER FOR SOUND AND VIBRATION

The Center for Sound and Vibration, established in 1969 and administered within the Department of Mechanical and Aerospace Engineering, is composed of faculty pursuing the solution of a wide variety of problems such as occur in machinery and aircraft design particularly related to vibration and sound. Graduate programs exist at M.S. and Ph.D. levels in fields such as noise and vibration control, aeroacoustics, hearing conservation, computer-aided machinery design, architectural and musical acoustics, and acoustic signal processing. Outstanding experimental facilities, which include large anechoic and reverberant rooms and computer graphics equipment, are available. The Center's programs are financed largely by grants and contracts from industry and federal and state agencies.

COUNSELING LABORATORY

The Department of Counselor Education maintains a special counseling facility on the fifth floor of Poe Hall. The laboratory is staffed by professionally trained graduate students under the supervision of departmental faculty. The major emphasis is on helping a wide variety of persons who face educational, career and personal decisions through short-term counseling and advising. Occupational exploration and aptitude testing are often included. A minimal fee (\$10.00) is charged. Appointments are available during the fall and spring semesters.

DIAGNOSTIC TEACHING CLINIC

The Diagnostic Teaching Clinic is operated by the graduate program in special education within the School of Education for the purposes of providing graduate students with opportunities to gain both observational and applied clinical experience in diagnosing and teaching handicapped children of all ages. The clinic accepts referrals from local school systems and from nonpublic school agencies, and the students and staff evaluate the referred children, develop educational programs for them in conjunction with the referring agency and demonstrate teaching techniques for the benefit of those persons who will work with the children. This clinic is open during the day, late afternoon and early evening hours during the fall and spring semesters and is utilized by graduate students from several departments with allied curricula in education and psychology.

ELECTRON MICROSCOPE FACILITIES

There are four electron microscope facilities at N.C. State available to graduate students and faculty for research purposes. The School of Agriculture and Life Sciences (SALS) Center for Electron Microscopy is located in Gardner Hall, the Engineering Research Microscope Facility is in Burlington Engineering Labs and the Department of Wood and Paper Science Electron Microscopy Lab is in Biltmore Hall. The new School of Veterinary Medicine (SVM) Electron Microscopy Laboratory is located in the N.C. State School of Veterinary Medicine on Hillsborough Street.

The SALS Electron Microscope Center has two scanning microscopes: an ETEC U-1 and a JEOL T-200 and four transmission electron microscopes: an Hitachi HS-8-B, an Hitachi HU-11-B, a JEOL 100-S and a Philips 400T-STEM. The Center also makes available all of the necessary biological preparatory equipment.

Formal instruction is provided through the biological sciences curriculum for transmission electron microscopy, scanning electron microscopy and ultramicrotomy. Advanced techniques are provided on an individual basis or through workshops.

The Engineering Research Analytical Instrument Center is equipped with new Hitachi scanning transmission (model H-800) and scanning electron (model S-530) microscopes, both equipped with energy-dispersive X-ray spectrometers (Tracor Northern TN 2000 and Dapple Systems MicroPlus+) in addition to older JEOL and Cambridge SEM's and a JEOL TEM.

The H-800 STEM has a maximum accelerating voltage of 200 kV and a lanthanum hexaboride gun, providing high image brightness and penetration with minimal specimen damage, which is used for ceramic, metallurgical, electronic and textile materials. Computer control of all lenses and a motorized 45-degree double-tilting stage make it easy to use, and a high takeoff angle X-ray detector provides high sensitivity elementary analysis, including mapping and quantitative capability. The instrument operates in scanning, transmission and STEM modes with full diffraction capability.

The S-530 SEM accommodates large (6-inch) specimens, has an ultra-low voltage mode for uncoated surface examination and has highly automated focus and picture-taking controls for routine high-quality images. In addition to 50-angstrom

resolution secondary electron pictures, the microscope is equipped with a high-resolution backscattered electron detector and a computerized quantitative X-ray spectrometer.

Both microscopes are supported by complete specimen preparation and darkroom facilities and an extensive computerized image processing, analysis and measurement system (Dapple Imageplus+). The analytical instruments center also operates an electron probe microanalyzer (AMR/3) for wavelength dispersive X-ray analysis on the micrometer level, several light microscopes and X-ray diffractometers, and an Auger electron spectrometer with ion sputtering which allows depth profiling of elemental composition.

In addition, an ion probe microanalyzer (Cameca IMS 3f) performs secondary ion mass spectrometry (SIMS) with sub-micron lateral resolution and atomic layer depth resolution and typical detection limits in the ppm-ppb range. Both oxygen and cesium ion sources are available and a digital imaging system is used to interpret the three-dimensional elemental distributions. The instrument is used particularly for engineering, electronic and biological materials.

Center personnel teach regular courses covering many of these instrument techniques as well as short courses and offer collaboration with and instruction for graduate students on an individual basis.

The Department of Wood and Paper Science Microscopy Lab is equipped with a Siemens Elmskop-1A transmission electron microscope as well as all other equipment necessary for the preparation and study of specimens. Instruction for graduate students engaged in research is on an individual need basis.

The SVM Electron Microscopy Laboratory is a new facility housing a Philips 410 state-of-the-art transmission electron microscope for biological specimens and a JOEL JSM-35 scanning electron microscope. All the back-up equipment for preparing specimens to be viewed with either instrument are housed within the Laboratory as well as complete darkroom facilities for the preparation of routine and publication material.

HIGHLANDS BIOLOGICAL STATION

North Carolina State University is an institutional member of the Highlands Biological Foundation which provides support for the Highlands Biological Station of the University of North Carolina. This is an inland biological field station located at Highlands, North Carolina. The town of Highlands is in the heart of the Southern Appalachians at an elevation of 3,823 feet. The area has an extremely diverse biota and the highest rainfall in the eastern United States.

Facilities are available throughout the year for pre- and post-doctoral research in botany, zoology, soils and geology. The laboratory building with research rooms and cubicles and the library are well equipped for field-oriented research. Also, five cottages and a dining hall are located on the edge of a six-acre lake. In addition to 16 acres surrounding the lake, the station owns several tracts of undisturbed forested land available for research. Research grants available through the Station provide stipends for room, board and research expenses.

INTEGRATED MANUFACTURING SYSTEMS ENGINEERING INSTITUTE

The Integrated Manufacturing Systems Engineering Institute has been established at North Carolina State University to provide a multifaceted educational, research and technology transfer initiative in manufacturing systems engineering. The objectives of this program to educate engineers in the theory and practice of advanced design and manufacturing methods; to conduct basic and applied research on topics related to contemporary manufacturing problems; and to engage in technology transfer to increase productivity and the quality of manufactured products.

Central to all aspects of the Institute's operation and activity is the integration of computer-aided processes in the design and control of manufacturing facilities in order to strengthen the country's ability to produce manufactured goods of improved quality at lowered cost. Through both internally and externally funded research projects the Institute plans to contribute to the solution of generic design and manufacturing engineering problems and to provide a vehicle for technology transfer.

MATERIALS RESEARCH CENTER

The Materials Research Center was established in 1984 at NCSU as an interdisciplinary program involving persons representing the Department of Chemistry, Electrical and Computer Engineering, Materials Engineering and Physics. The initial thrust area of the Center involves fundamental studies in the epitaxy of compound semiconductors. The Center serves as a focal point for this cooperative research. However, the experimental efforts are conducted within the four departments noted above.

MICROELECTRONICS CENTER OF NORTH CAROLINA

North Carolina State University is a participating member of the Microelectronics Center of North Carolina (MCNC) which has been established to support the academic and research programs in microelectronics in North Carolina. Other participating institutions are the University of North Carolina at Chapel Hill, Duke University, North Carolina Agricultural and Technical State University, the Research Triangle Institute and the University of North Carolina at Charlotte.

MCNC consists of a Semiconductor Research and Integrated Circuit Design and Fabrication Facility located at the Research Triangle Park near Raleigh and a teaching and research Integrated Circuit Fabrication Facility located on the NCSU campus. These facilities are dedicated to the support of VLSI (Very Large-Scale Integration) microelectronics teaching and research programs at the participating institutions. Faculty and students at NCSU have access to the use of MCNC facilities on sponsored research projects and for formal academic courses including microelectronics design and fabrication laboratories. Areas of interest include systems design, systems engineering, integrated circuit technology, semiconductor materials and device physics. Departments at NCSU which are actively involved in the program include Electrical and Computer Engineering, Computer Science, Physics, Chemistry and Materials Engineering.

NUCLEAR REACTOR PROGRAM FACILITIES

The Nuclear Reactor Program provides specialized nuclear facilities to the educational, industrial and governmental organizations of North Carolina for the purposes of teaching, research and service. The Program facilities include (i) the PULSTAR, a 1-megawatt research and training nuclear reactor with unique neutron irradiation capabilities, (ii) an analytical laboratory featuring neutron activation analysis and radioisotope production and measurement and (iii) a thermal-hydraulics laboratory which is developing a freon loop to simulate the operation of a pressurized water reactor. The Nuclear Reactor Program is associated with the Department of Nuclear Engineering and is located in the Burlington Engineering Laboratories on campus.

ORGANIZATION FOR TROPICAL STUDIES

North Carolina State University shares with the University of North Carolina at Chapel Hill an institutional membership in the Organization for Tropical Studies (OTS), a consortium of North and Central American universities which maintains field research and teaching facilities in Costa Rica. Each year OTS sponsors courses in tropical biology that are open to NCSU graduate students with biological science backgrounds. These 8-week courses, offered in winter and summer, are taught in Costa Rica and make use of a network of field stations located throughout the country. NCSU is an active participant in the OTS graduate education program, with an average attendance of two students per year in the tropical biology courses.

The OTS facilities in Costa Rica also provide a unique opportunity for tropical research by NCSU graduate students and faculty. The principal field station, located in the northeastern Atlantic lowlands, has excellent laboratory and housing facilities and provides access to a 3,500-acre tract owned by OTS; 65% of this tract is undisturbed lowland tropical wet forest. Another station is located at mid-elevation in southeastern Costa Rica near the Panamanian border. OTS also utilizes various other sites, including a seasonally dry area in the northwestern part of the country and a high-elevation area at 10,000 feet in the Talamanca range. More information about OTS may be obtained from the campus representative, who can be contacted through the International Programs Office.

PESTICIDE RESIDUE RESEARCH LABORATORY

The Pesticide Residue Research Laboratory is a facility in the School of Agriculture and Life Sciences devoted to research on pesticide residues in animals, plants, soils, water and other entities of man's environment. Although the laboratory is administered through the Department of Entomology, it serves the total needs of the School in cooperative research projects requiring assistance on pesticide residue analysis.

The laboratory functions as a focal point for residue research involving inter-departmental cooperation, but faculty in the laboratory also conduct independent pesticide research on persistence and decomposition in soils and plants, absorption and translocation in plants, distribution in environment and contamination of streams, estuaries and ground water.

The laboratory is equipped with the latest analytical instruments. Graduate study can be undertaken in any aspect of pesticide residues either in the Pesticide Residue Research Laboratory or in one of the cooperating departments.

PRECISION ENGINEERING LABORATORY

The Precision Engineering Laboratory was established with a \$1.25 million grant from the Office of Naval Research in 1982. The goal is to develop techniques for precision manufacturing at tolerances below those attainable with current technology. For example, fabrication of electro-optical devices require manufacturing tolerances better than 1 millionth of an inch. This goal requires new methods for monitoring and controlling the parts being produced or the process being performed. Specific research objectives involve the study of metrology systems, control algorithms/processors, machine structure/dynamics, optics, materials, sensors and the details of many different fabrication processes. An interdisciplinary team of faculty, research staff and graduate students are working together to address these research areas.

In 1985 the program was expanded with industrial and national laboratory support. These organizations foresee the need for scientists and engineers with a background in precision engineering as well as new technology to meet their growing demands for high-precision products. With this expanded base of support, the Precision Engineering Laboratory is fulfilling these needs.

PSYCHO-EDUCATIONAL CLINIC AND LABORATORIES

The Department of Psychology operates the Psycho-Educational Clinic located in Poe Hall. The clinic provides both a service to the public and training for school psychology graduate students. School-age child assessment and program development are the major services provided. Coordination of internships and practica is also administered through this facility.

Each graduate program in psychology also has laboratory facilities, either independently or shared. Thus, the experimental psychology program has laboratories for neuropsychology, auditory and visual perception, cognition and operant behavior. There is also a training and development laboratory as well as facilities for ergonomics, applied developmental educational psychology, human resource development, industrial/organizational and vocational psychology and social psychology. The latter facilities include one-way viewing rooms with appropriate audio and video recording equipment.

REPRODUCTIVE PHYSIOLOGY RESEARCH LABORATORY

The Reproductive Physiology Research Laboratory administered through the Department of Animal Science includes environmental control rooms designed to provide constant levels of air temperature, humidity and light for animals involved in studies on reproduction. Facilities and equipment are available for surgery, in vitro growth of embryos, isotope labeling in embryo metabolism and transfer of embryos between females.

Support for research at both the master's and the doctoral levels is available. Students may elect a comparative approach to a specific problem in mammalian

reproduction, working with several species, or they may choose to work with a single species. Generally students select a problem associated with the identification of factors influencing early prenatal development, the endocrine control of ovarian function or some aspect of elucidation and control of aberrations in mammalian reproduction.

Cooperative research is possible between the laboratory, the School of Veterinary Medicine and the Medical School or the Environmental Health Sciences Center at the University of North Carolina at Chapel Hill for those students desiring a broader training in the general area of reproductive physiology.

Students whose work is concentrated in reproductive physiology can major in either animal science or physiology with a minor in related disciplines.

SEA GRANT COLLEGE PROGRAM

The University of North Carolina Sea Grant College Program is a state/federal partnership program involving all campuses of the UNC system. A majority of its activities, however, are conducted at the N. C. State University campus. Sea Grant combines the University's expertise in research, extension and education to focus on practical solutions to problems in the area of coastal and marine resource use and conservation. Graduate and undergraduate research opportunities rest with individual project directors on campus and a special fellowship program administered through the program office.

SOUTHEASTERN PLANT ENVIRONMENTAL LABORATORIES— PHYTOTRON

The Southeastern Plant Environment Laboratory, often referred to as the North Carolina State University Phytotron, is especially designed for research dealing with the response of plants and microorganisms to their environment. A high degree of environmental control makes possible simulation of a wide range of climates found in tropical, temperate and northern zones.

Research in the Phytotron deals with all phases of plant biology. Although the majority of the studies are conducted with agricultural crop species, the Phytotron can accommodate ecological investigations, plant biology problems of the space program, experimental taxonomy and air pollution studies as well as basic physiological and biochemical research.

The Phytotron facility is available to the resident research staff, participants in graduate research programs of North Carolina State University and to domestic and foreign visiting scientists.

TRIANGLE UNIVERSITIES NUCLEAR LABORATORY

TUNL is a laboratory for nuclear structure research. Located on the campus of Duke University in Durham the laboratory is staffed by faculty members and graduate students in the Departments of Physics of Duke University, the University of North Carolina at Chapel Hill and North Carolina State University. Particle accelerators are used to bombard target nuclei with an assortment of ions of accurately controlled energy spread and spin orientation. The accelerators are a 15 MeV tandem Van de Graaff generator into which negative ions are injected by a 15

MeV AVG cyclotron and a 3 MeV and a 4 MeV Van de Graaff generator. Polarized and pulsed beams are available as well as a new polarized target. On-line computers are used for data collection and analysis.

Personnel from NCSU are partners in the maintenance and operation of the laboratory. There is extensive collaboration with personnel from the other two participating universities. This laboratory, which began operation in 1968, was the first to combine a cyclotron and tandem Van de Graaff generator—the “Cyclo-Graaff.”

Special Program

RESEARCH PROGRAM AT THE OAK RIDGE ASSOCIATED UNIVERSITIES

North Carolina State University is one of the sponsoring institutions of the Oak Ridge Associated Universities at Oak Ridge, Tennessee. Through this cooperative association, North Carolina State's graduate research program has at its disposal the facilities and research staff at Oak Ridge National Laboratory. Extensive research programs are underway there on physical and biological effects of radiation, radioisotope utilization, materials microstructure and many other areas of materials and nuclear science and engineering. When master's and doctoral candidates have completed their resident work, it may be possible, by special arrangement, for them to do their thesis research at Oak Ridge National Laboratory. In addition, it is possible for the staff members of this University to go to Oak Ridge for advanced study in their particular fields.

Nondiscrimination Statement

North Carolina State University is dedicated to equality of opportunity within its community. Accordingly, North Carolina State University does not practice or condone discrimination, in any form, against students, employees or applicants on the grounds of race, color, national origin, religion, sex, age or handicap. North Carolina State University commits itself to positive action to secure equal opportunity regardless of those characteristics.

North Carolina State University supports the protection available to members of its community under all applicable Federal laws, including Titles VI and VII of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, Sections 799A and 845 of the Public Health Service Act, the Equal Pay and Age Discrimination Acts, the Rehabilitation Act of 1973, the Vietnam Veterans Readjustment Assistance Act of 1974, and Executive Order 11246. For information concerning these provisions, contact:

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University Patent and Copyright Procedures

North Carolina State University is dedicated to teaching, research and extending knowledge to the public.

It is the policy of the University to carry out its scholarly work in an open and free atmosphere and to publish results obtained therefrom freely, limited only by a short time delay in cases in which this is necessary to establish patent rights. Although the University does not undertake research or developmental work principally for the purpose of developing patents and commercial applications thereof, patentable inventions sometimes arise out of the research activities of its employees which are carried out wholly or in part with University facilities. As a public service institution, the University has an interest in assuring the utilization of such inventions for the public good. Protection must be provided to at least some of these inventions through patents and licenses to encourage their development and marketing. Patents and their exploitation, however, represent only a small part of the benefits accruing from either publicly or privately sponsored research.

A portion of the research conducted by the University is supported by government and a portion by private industry. Service to the public, including private industry, is an integral part of the University's mission. As a public institution, the University, in its agreements with private industry or other private organizations, must keep the interests of the general public in view. The rights and privileges set forth in cooperative agreements or contracts, with respect to patents developed as a result of research partly or wholly financed by private parties, must be fair and just to the inventor(s), the sponsor and the public. Research should be undertaken by the University under support from private parties only if it is consistent with and complementary to the University's goals and responsibilities to the public.

SECTION 100—Purposes:

The North Carolina State University Patent and Copyright Procedures are designed to implement the Patent and Copyright Policies of The University of North Carolina. The procedures incorporate the interests of the faculty, staff, and students, the institution, and the sponsors of research, because in many cases those interests are congruent in desiring to encourage innovation and assure broad dissemination of the results of research. These procedures are designed to stimulate and recognize creativity among the faculty, staff, and students, and to establish an institutional process that is flexible enough to accommodate the different types of research and patentable work conducted at a comprehensive research university such as NCSU. Equity and fairness are goals of the procedures in all respects, not only in the distribution of royalty, but also in recognition. While much documentation related to patents, by its very nature, must be confidential, these procedures are designed to be understood by all faculty, staff and students so that they may take advantage of the options available for transfer of University discoveries into useful products that benefit the public. Finally, these procedures should provide an efficient and timely mechanism for reaching a decision about patenting with a minimum involvement of the inventor's time so that he or she may continue to be productive in the laboratory and classroom. To this end the University employs a

patents administrator whose duties include providing assistance to faculty, staff and students in matters related to inventions.

SECTION 200—Ownership:

1. As defined by the Patent and Copyright Policies of the Board of Governors of The University of North Carolina, to which these Procedures are expressly subject, North Carolina State University has a legal interest in all inventions of University personnel, including students, that are conceived or first actually reduced to practice as a part of or as a result of: (a) University research; (b) activities within the scope of the inventor's employment by, or official association with, the University; and (c) activities involving the use of University time, facilities, staff, materials, University information not available to the public, or funds administered by the University.

2. Faculty, staff, and students, whose inventions are made on their own time, outside the scope of their employment or association with the University and without University facilities, materials, or resources and which inventions are, therefore, their exclusive property as specified by the Patent and Copyright Policies, may submit their invention to the University for possible patenting and/or commercial exploitation and management under terms to be agreed upon by the inventor and the University.

3. The provisions of the NCSU Patent Procedures are subject to any applicable laws, regulations or specific provisions of the grants or contracts which govern the rights in inventions made in connection with sponsored research.

4. Under the terms of certain contracts and agreements between NCSU and various agencies of government, private and public corporations, and private interests, NCSU is or may be required to assign or license all patent rights to the contracting party. NCSU retains the right to enter into such agreements whenever such action is considered to be both in its best interest and in the public interest. Ordinarily, the University will not agree to assign rights in future inventions to private corporations or businesses except as set forth in these procedures.

5. All faculty, staff and students engaged in University related or sponsored research shall sign a Patent Agreement.

SECTION 300—Responsibilities of NCSU Personnel:

1. NCSU personnel who, either alone or in association with others, make an invention in which NCSU has or may have an interest shall disclose such inventions to the Vice Chancellor for Research. The Vice Chancellor for Research will promptly acknowledge receipt of disclosures and will distribute the disclosures to the Patent Committee for consideration at its next meeting.

2. For any invention in which the University has an interest, the inventor, upon request of the Vice Chancellor for Research shall execute promptly all contracts, assignments, waivers or other legal documents necessary to vest in the University or its assignees any or all rights to the invention, including complete assignment of any patents or patent applications relating to the invention.

3. NCSU personnel may not: (a) sign patent agreements with outside persons or organizations that may abrogate the University's rights and interests either as

stated in the Patent Policies or as provided in any grant or contract funding the research which led in whole or in part to making the invention, nor (b) without prior authorization, use the name of the University or any of its units in connection with any invention in which the University has an interest.

4. All faculty teaching courses in which students do work that may lead to patentable inventions should inform the students of the existence of the NCSU Patent and Copyright Policies and of these Procedures.

SECTION 400—Suggested Procedures For Record-Keeping:

1. U.S. patent practice places a premium on witnessed records when two or more parties claim the same invention. The date the idea occurred (the “conception”) and the date it was put into practice form (“reduced to practice”) are vital. Equally important in the eyes of the Patent Office is the “diligence” shown by contending inventors. They must prove that they regularly pursued work on the invention, documenting their efforts on a day-by-day basis. The intent of U.S. patent laws is to recognize the first inventor; the one who originated the idea. Under these laws, the first to conceive and reduce to practice will receive a patent if his records bear out his claims; the first to conceive and the last to reduce to practice may win if his records show diligence.

2. The careful recording of ideas and laboratory data is a matter of routine for industrial researchers. Each entry is complete and up-to-date, signed and witnessed; a legal record of the day’s work. Record-keeping is not nearly so simple for the academic investigator, for he or she may work at odd hours or on weekends; may be closeted in a laboratory, an office or at home; and often lacks easy accessibility to suitable witnesses. Still, the keeping of a witnessed laboratory notebook is advisable. Additionally, such records can serve as valuable repositories of new ideas.

SECTION 500—The Handling of a Disclosure:

1. When faculty or staff members make an invention, it shall be their responsibility to discuss their discovery or invention with the Department Head at which time the possibility of exploring patenting should be considered. Students should first discuss an invention with their instructor, who shall assist them in further discussion within the University. The patents administrator is available to discuss possible inventions and to assist faculty, staff and students in the preparation of disclosures. If the invention appears to be a matter that should be considered for patenting, the inventor(s) should prepare a disclosure utilizing guidelines for invention disclosures which can be obtained for the patents administrator. The Department Head should transmit the disclosure through the Dean of his School to the Vice Chancellor for Research for consideration by the Patent Committee.

2. Upon receiving a disclosure, the Chairman of the Patent Committee may refer the disclosure to one of several technical advisory committees to the Patent Committee. Technical advisory committees will be appointed by the Vice Chancellor for Research and will be composed of faculty and staff who are knowledgeable and experienced in broad disciplinary or cross-disciplinary areas. These individuals will be asked to review the disclosure from the point of view of whether or not, based on

their knowledge, they believe the invention, if patented, would be a strong, viable, commercial product that would have a large market. The technical advisory committee in each area will meet prior to each Patent Committee meeting if they have any disclosures presented to them, and will discuss the disclosures and make to the Patent Committee, prior to its meeting, one of the following recommendations:

A. That the disclosure has significant commercial possibilities.

B. That the disclosure does not appear to have significant commercial possibilities.

C. That the technical advisory committee could not determine, based on its knowledge, whether or not the disclosure has significant commercial possibilities.

3. The Patent Committee will review each written disclosure promptly. The inventor or a representative shall be allowed to examine all written materials submitted to the Committee in connection with the disclosure and to make a written and oral presentation to the Committee. The Committee will decide on a disposition of the invention to secure the interests of the University, the inventor, the sponsor, if any, and the public. Its decision may include, but is not limited to, one or a combination of the following:

A. To submit the disclosure for review by a patent or invention management firm or agent;

B. To make inquiries of potential licensees that may have an interest in the invention, including the financing of a patent application, where applicable;

C. To conduct a patent search concerning the patentability of the disclosure;

D. To apply for a patent with University resources (an option with limited application because of financial constraints);

E. To release University rights to the inventor subject to an agreement to protect the interests of the University, the sponsor, if any, and the public, including an obligation to pay to the University a percentage of future royalties or profits in cases where it is necessary to recognize the University's contribution;

F. To dedicate the invention to the public;

G. To waive further University interest in the invention.

4. Normally, within four weeks of the receipt of the disclosure, the inventor will be notified in writing of the decision of the Committee on (a) the equities involved including financial participation, (b) whether the University plans to file a patent application, or (c) whether the University will accept assignment of the invention for patenting, licensing and/or commercial handling as applicable. If the University chooses not to file a patent application for an invention in which it has rights, or not to license the invention, or not to dedicate it to the public, upon the inventor's written request the invention, at the Committee's discretion, may be released in writing to the inventor, with the permission of the sponsor, if any.

5. In those cases in which the University has obtained a patent without obligation to sponsors, if no arrangement has been made for commercial development within five years from the date of the issuance of the patent, the inventor(s) may request in writing an assignment of the University's patent rights. The Patent Committee will promptly either grant the request or advise the inventor of the University's plans for the development of the invention.

SECTION 600—Royalty:

1. NCSU shall share with the inventors revenue it receives from patents or inventions. As noted in Section 200 (4), specific provisions of grants or contracts may govern rights and revenue distribution regarding inventions made in connection with sponsored research; consequently, revenues the University receives from such inventions may be exclusive of payments of royalty shares to sponsors or contractors.

2. The gross royalty revenues (net amount received by the University if there is a specific agreement in a grant or contract with a sponsor) generated by a patent or invention shall be the basis upon which the inventor's royalty is calculated. Unless otherwise agreed, the inventor's share of royalty revenues shall be 25% of the gross revenue. In the case of co-inventors, the 25% of gross revenue shall be subdivided equally among them, unless the inventors, with the concurrence of the Patent Committee, determine a different share to be appropriate. All such determinations shall be made in writing at the time of disclosure. Applicable laws, regulations or provisions of grants or contracts may, however, require that a lesser share be paid to the inventor. In no event shall the share payable to the inventor or investors in the aggregate by the University be less than 15% of gross royalties received by the University.

3. To the extent practicable and consistent with State and University budget policies, the remaining revenue received by the University on account of an invention will first be applied to reimburse the University for expenses incurred by it in obtaining and maintaining patents and/or in marketing, licensing and defending patents or licensable inventions and the remainder will be dedicated to research purposes that may include research in the inventor's department or unit, if approved by the Chancellor upon recommendation of the Patent Committee.

SECTION 700—Inventor Requests for Waiver of University Rights:

1. If an inventor believes that the invention was made outside the general scope of his or her University duties, and if the inventor does not choose to assign the rights in the invention to the University, he or she shall, in the invention disclosure, request that the Patent Committee determine the respective rights of the University and the inventor in the invention and shall also include information on the following points:

- A. The circumstances under which the invention was made and developed;
- B. The employee's official duties at the time of the making of the invention;
- C. The inventor's intention to request an acknowledgment that the University has not claim if such request is deemed appropriate;

D. The extent to which the inventor is willing voluntarily to assign domestic and foreign rights in the invention to the University if it should be determined that an assignment of the invention to the University is not required under the Patent and Copyright Policies;

E. The inventor's intention to request that the University prosecute a patent application if it should be determined that an assignment of the invention to the University is not required under the Patent and Copyright Policies.

SECTION 800—Publication and Public Use

1. North Carolina State University strongly encourages scholarly publication of the results of research by faculty and students. Though the Patent and Copyright Policies do not limit the right to publish, except for short periods of time necessary to protect patent rights, publication or public use of an invention constitutes a statutory bar to the granting of a United States patent for the invention unless a patent application is filed within one year of the date of such publication or public use. Publication or public use also can be an immediate bar to patentability in certain foreign countries.

2. In order to preserve rights in unpatented inventions, it shall be the duty of the inventor, or of his supervisor if the inventor is not available to make such report, to report immediately to the Vice Chancellor for Research any publication, submission of manuscript for publication, sale, public use, or plans for sale or public use, of an invention, if a disclosure has previously been filed. If an invention is disclosed to any person who is not employed by the University or working in cooperation with the University upon that invention, a record shall be kept of the date and extent of the disclosure, the name and address of the person to whom the disclosure was made, and the purpose of the disclosure.

After disclosure to the Patent Committee, the inventor shall immediately notify the Vice Chancellor for Research of the acceptance for publication of any manuscript describing the invention or of any sale or public use made or planned by the inventor.

SECTION 900—Contractual Arrangements:

1. North Carolina State University will normally seek a waiver of patent rights in contracts and grants with Federal agencies and in doing so will comply with the provisions of Federal law concerning the granting of waivers.

2. The University normally reserves the right to ownership of patents on inventions arising out of research supported in whole or in part by grants or contracts with non-governmental organizations or firms. Contracts or agreements which are entered into between the University and such organizations or agencies should contain clauses setting forth such a reservation unless deviations therefrom are requested by the sponsor and approved by the Vice Chancellor for Research. In the interest of fair treatment to the sponsor in consideration for his investment and in the interest of discharging the University's obligation to the public in the application of its facilities and employee time and talent, special provisions may be negotiated by the Vice Chancellor for Research in such non-government sponsored contracts on options such as the following:

A. The University will retain rights to patents arising out of such sponsored research but, if a significant portion of the research costs are borne by the sponsor, the sponsor may be assured a non-exclusive, non-reassignable license at a most favorable royalty rate for the use of the patent.

B. If the sponsor bears essentially all of the costs of the concerned research, including full overhead and all other indirect costs, the University may agree to assign its rights to patents generated thereunder to the sponsor if it wishes to exercise them, but only under an agreement in which the University is free to use the

invention for its own research and/or educational purposes without payments of royalty fees. In case the University assigns its patent rights to the sponsor under this option, the sponsor shall be obligated to utilize the patent, and the agreement shall specify that in case of failure to exercise diligent use of the patent commercially within a specified period as agreed upon, including offering the products manufactured thereunder for general public sale, the patent would revert to the University and the University would be free to proceed with licensing and application of the invention covered thereby in any manner it sees fit.

C. If both the sponsor and the University contribute shares in the costs of the sponsored investigations, first choice to patent rights on inventions made thereunder may be, by specification in the agreement, accorded to either party but with the stipulation that the party holding patent rights will be obligated to exercise use of the patent(s) and with options to the other party in case of failure to apply the patent diligently in commercial practice as set forth in B above. In any case, the agreement shall stipulate that the University would be free to use the invention for its own research and/or educational purposes without payment of royalty fees. Under this option, the University and the sponsor shall agree to share in net royalties accruing from the patent(s) and the licensing of same in proportions approximately equal to their respective declared and verified proportionate shares in the costs of the investigations, unless the University should elect to dispose of its share by direct sale to the sponsor for an agreed price.

D. In order to protect the potential patent interests of both parties in such contracts in which the sponsor is accorded patent rights, the following procedure may be specified:

"When in the course of the sponsored research project the investigator or investigators conceive or reduce to practice some discovery which appears to be patentable, then the inventor(s) will immediately inform the sponsors and the University of such discovery and will, for a specified period as negotiated (normally three months but in any case not more than twelve months), make available to the sponsor all pertinent information and disclosures which may be required for the development of an appropriate patent application. During this period, the investigators agree not to disclose this material to the public and agree to cooperate in the sponsor's effort to secure the patent. At the end of this agreed period, the investigators and the University will be free to proceed with publications and making public such other documents as they may choose. With the exception of the above mentioned agreed period, the University will operate industry sponsored contracts in the normal manner with no other special considerations being given to the sponsor. Under no circumstances will the sponsor have the right to prevent the publication of material or information derived during the conduct of the program or as a result thereof other than for the agreed period indicated above."

Prior written agreement of the investigators involved in research investigations to be carried out under these conditions must be secured by the University to enable the University to discharge its agreed obligations under such a contract.

SECTION 1000—Patent Management and Administration:

1. North Carolina State University recognizes that the evaluation of inventions and discoveries and the administration, development and processing of patents and

licensable inventions involves substantial time and expense and requires talents and experience not ordinarily found among its faculty and staff; therefore, it employs the Director, Office of Technology Administration to provide assistance. The University may contract with outside agents for certain services. It may enter into a contract or contracts with an outside organization covering specific inventions or discoveries believed to be patentable and patents developed therefrom or covering all such inventions, discoveries and patents in which the University has an interest. The University may manage an invention using its own resources.

2. The Chancellor shall appoint a Patent Committee consisting of no fewer than three members. The Vice Chancellor for Research shall serve as Chairman of the Committee. The Committee shall review and recommend to the Chancellor or his delegate changes in these Procedures, decide upon appropriate disposition of invention disclosures, resolve questions of invention ownership, recommend to the Chancellor the expenditure of invention royalties, and make such recommendations as are deemed appropriate to encourage disclosures and to assure prompt and effective handling, evaluation, and prosecution of invention opportunities and to protect the interests of the University and the public. The Director of the Office of Technology Administration shall serve as staff for the Committee and shall attend all meetings.

SECTION 1100—Copyright Procedures:

1. As a general rule, all rights to copyrightable material are the property of the creator. The distribution or royalties, if any, is a matter of arrangement between the creator and his publishers or licensees. Different treatment may be accorded by the University in case of specific contracts providing for an exception, in cases where the University or sponsor may employ personnel for the purpose of producing a specific work, where different treatment is deemed necessary to reflect the contribution of the institution to the work, as in the case of software* or audiovisual material, or where a sponsored agreement requires otherwise. All agreements concerning copyright ownership should be in writing and should be signed by the parties and approved by the Vice Chancellor for Research prior to the commencement of the work.

2. An institute, center, or other unit of the University that is itself a publisher and that engages faculty members and other employees to write for publication by that unit as a part of their professional duty or produce other copyrightable materials, such as audiovisual materials or computer software, may, subject to the approval of the Vice Chancellor for Research, adopt rules providing that copyright on materials prepared by such faculty members and other employees in the course of their professional work for that unit vests in the University and not in the author.

The Patent Committee can explore the possibilities of commercial licensing of software developed and owned by the University. Inquiries about the possibilities of licensing software should be addressed to the Vice Chancellor for Research.

*Specific steps are being developed for clarifying the ownership of computer software, developing license agreements and distributing royalty. This information will be distributed as an appendix to these procedures.

GENERAL INFORMATION

Application

Applications for admission must be accompanied by the following: two official transcripts from all colleges and universities previously attended, references from at least three people who know of the student's academic record and potential for graduate study, a non-refundable application fee of \$25 and, in some cases, an official statement of the student's Graduate Record Examination scores.* Application and reference forms may be obtained by writing or visiting the Dean of the Graduate School, 104 Peele Hall, Box 7102, North Carolina State University, Raleigh, N. C. 27695-7102. When completed, all application materials should be returned according to instructions. Application is made for a specific degree program and date of enrollment (see "Admission").

International Students

Students whose native language is other than English, regardless of citizenship, must submit TOEFL (Test of English as a Foreign Language) scores as evidence of ability to use English at a level of competence sufficient for graduate work. A minimum TOEFL score of 500 and section scores of no less than 45 are required prior to admission. (Minimum score subject to change). The test date must be within 12 months of the date of application. All international students must be cleared by the Department of Foreign Languages and Literatures during the first two weeks of their initial semester in residence and may be required to take additional course work in English. In addition, the international applicant must provide the University with verification that the required funds are available to support the proposed program of advanced study. Foreign nationals in the United States at the time application is made must also provide information regarding their current visa status. The University provides special forms to be used by the applicant in supplying this information.

Admission

The procedures followed in evaluating an applicant's potential for success in graduate work and the criteria used for admissions decisions vary according to departments and schools and reflect an evaluation of the applicant's potential to

*The following departments and programs will not act on applications unless accompanied by GRE scores: biochemistry, biomathematics, botany, computer studies, crop science, ecology, education (all programs with the exception of the master's program in adult and community college education, psychology also requires the Advanced Test and Miller Analogies), electrical and computer engineering, English, entomology, forestry, genetics, horticultural science, history, industrial engineering, marine, earth and atmospheric sciences, mathematics, nutrition, plant pathology, political science and public administration, sociology, toxicology and zoology.

Many departments, although not normally requiring GRE scores, may in special instances require their submission as additional information to be used in making a judgment of the student's potential for success in a graduate program.

Information regarding the Graduate Record Examination and registration forms may be obtained from the Educational Testing Service, Box 955, Princeton, New Jersey 08540 or Box 1502, Berkeley, California 94701.

engage in graduate work and the capability of the individual departments to accommodate additional students. Most departments consider applications as they arrive, while others accumulate applications and make recommendations on admission at certain times during the year. Generally, requests for admission are considered by departmental admissions committees which forward the departmental recommendations to the Dean of the Graduate School.

Students are admitted to full or provisional status in a specific degree program. Admission is granted for a specific semester or summer term. Any change in the admission date must be requested in writing and approved by the department and Graduate School. Once the requirements for that degree program have been completed, no further registration as a graduate student will be permitted unless admission to a new graduate classification has been formally approved. Students with special objectives may request admission as "Graduate-Unclassified Students" (see below) or register in the "Post-Baccalaureate Studies" program (see next page) through the Division of Continuing Education.

FULL GRADUATE STANDING

To be considered for admission in full graduate standing, an applicant must have a baccalaureate degree from a college or university recognized as standard by a regional or general accrediting agency and must have at least a "B" average in the undergraduate major.

PROVISIONAL ADMISSION

1. Provisional admission may be granted to applicants with bachelor's degrees from accredited institutions who lack undergraduate work considered essential for graduate study in a major field. Course work, without graduate credit, will be required to make up such deficiencies before admission to full status can be granted.

2. Applicants with bachelor's degrees from nonaccredited institutions may be granted provisional admission when their academic records warrant this status. Additional course work will be required of such students when deficiencies in previous training are apparent.

3. Students with bachelor's degrees from accredited institutions whose scholastic records are below the standards for admission to full graduate standing may be admitted provisionally when unavoidable, extenuating circumstances affected their undergraduate averages or when progressive improvement in their undergraduate work warrants provisional admission.

A graduate student admitted to provisional status is not eligible for appointment to an assistantship or fellowship. Full graduate standing is granted when the deficiencies responsible for the provisional status are corrected, provided the student has maintained a satisfactory academic record (3.0 Grade Point Average) on all course work taken in a graduate classification. A change from provisional status to full graduate standing is effected only upon the recommendation of the department in which the student is seeking the degree.

GRADUATE-UNCLASSIFIED STUDENTS

The Graduate-Unclassified status is a temporary classification and students admitted to this status are not candidates for degrees. They may take courses for graduate credit but may not apply more than 10 credits earned while in this status to any program leading to an advanced degree at this institution. Unclassified graduate students are expected to meet the same admissions requirements that apply to graduate students in full standing. Any individual having an interest in applying for admission as a Graduate-Unclassified Student should correspond with the Graduate Dean describing his or her particular interests and objectives prior to making application.

POST-BACCALAUREATE STUDIES (PBS)

The Post-Baccalaureate Studies (PBS) classification is designed for U. S. citizens who wish to undertake academic work beyond the baccalaureate degree but who are not currently admitted to a degree program. This classification is not open to international students with the exception of the spouse of a regularly enrolled NCSU student. In special cases where students are sponsored by an agency of the U. S. government for specialized, non-degree study, approval may be given by the Graduate School for registration in the Post-Baccalaureate Studies classification. The following policies apply to students who wish to register for PBS:

1. All must have baccalaureate degrees from accredited institutions of higher education.
2. All classes taken for credit by PBS students will be graded in the usual manner that applies for the particular course (A,B,C,D,NC or S,U). All courses taken at NCSU will show on the student's transcript. If the student is admitted as a graduate student, a maximum of nine hours may apply toward the minimum requirements of the degree for which the student is enrolled, including hours approved for graduate credit while classified as a senior, unclassified undergraduate or professional engineering student. Only the *first* nine hours of course work taken at the graduate level in the PBS category can be accepted toward degree requirements unless a request for some other combination of nine hours is made by the student's advisory committee and approved both by the School Dean and the Graduate Dean.
3. The grade point average (GPA) of a graduate student who has credits in the PBS category will be based on all courses taken at the 400-600 level. However, no course taken six (6) years prior to enrollment into a program will be considered in the GPA calculation.
4. Registration is limited to a maximum of two courses per semester. Individuals who are employed full-time should limit their PBS registrations to one course per semester.
5. The PBS classification carries with it no implication that the student will be admitted to the Graduate School in any degree classification.
6. All course work accepted for degree credit must be approved by the student's advisory committee as being germane to the program. Requests for degree

credit for courses completed in the PBS classification are considered after admission to a graduate degree program when the student's Plan of Graduate Work is filed with the Graduate School.

7. PBS students are expected to familiarize themselves with Graduate School policies and to seek further advice or clarification as needed.

Grades of all courses taken after the first nine hours will be recorded on PBS students' transcripts.

SCHOOL OF ENGINEERING PROFESSIONAL DEGREE PROGRAM

Professional degree students are admitted as undergraduate students, are classified as "PR" students and are subject to rules and regulations as established and administered by the Dean of the School of Engineering.

A professional degree student who is subsequently admitted to the Graduate School may, with the approval of the master's advisory committee, the major department and the Graduate School, receive graduate credit for a maximum of nine hours for courses in which a grade of "B" or higher was received.

Certificate Renewal

Public school personnel who are primarily interested in "certification credit" may enroll in the PBS program through the Division of Continuing Education without forwarding transcripts of previous work to the Graduate School. In such cases, the School of Education will be responsible for assessing the adequacy of the applicant's qualifications for enrollment in the course(s) concerned.

Registration and Records

The Office of Registration and Records must have authorization from the Dean of the Graduate School before a graduate student in any classification will be permitted to register for classes. This authorization will be sent to the Office of Registration and Records at the time the student is notified of acceptance for graduate study. All students attending classes must be registered for credit or audit.

Records of progress are kept by this institution on veteran and non-veteran students alike. Progress records are furnished the students, veterans and non-veterans alike, at the end of each scheduled school term.

REGISTRATION AFTER COURSE WORK COMPLETION

All students who are using University facilities must be registered. Students who are not in residence and do not require University facilities to complete their degree requirements are not required to be registered in the term the degree is awarded. The chair of the student's advisory committee is responsible for determining the status of the student who is not in residence with respect to use of University resources in the term of graduation and whether or not registration is required.

MEDICAL HISTORY

All graduate students admitted to a degree program are required by State law to submit a report of medical history prior to completing their initial registration. This report must document immunization against tetanus, measles, German measles and polio. N. C. State students returning to Graduate School must have their medical history on file updated. Please mail the medical history form to Student Health Service at least thirty days before registration.

INTERINSTITUTIONAL REGISTRATION

North Carolina State University participates in an Interinstitutional Registration program with the University of North Carolina at Chapel Hill, the University of North Carolina at Greensboro and Duke University. Under this agreement, graduate students enrolled at this university may undertake course work on these campuses upon the recommendation of their advisory committees. Courses offered by North Carolina A&T University and by the University of North Carolina at Charlotte over the Microelectronics Center of North Carolina Communications system are also available through Interinstitutional Registration.

Even though taking a course on another campus, the graduate student is exclusively under the administrative direction of the North Carolina State University Graduate School. Enrollment for courses on other campuses will take place on this campus, using special forms obtained from the Office of Registration and Records. The Graduate School shall consider courses taken on other campuses as a part of the student's normal load, and the billing for such work will be through the Office of Finance and Business. The procedures followed in the summer sessions are somewhat different; detailed instructions are available in the Office of Registration and Records.

When the grading system on the campus being visited is different from the North Carolina State University system, grades received under Interinstitutional Registration will be converted to the North Carolina State University system. "H," "P," "L" and "F" grades earned at the University of North Carolina at Chapel Hill and "E," "G," "S" and "F" grades earned at Duke University will be converted to "A," "B," "C" and "NC" grades, respectively.

COURSE LOAD

A full-time graduate course load is 9 to 15 credits per semester (including audits) and 6 credits per summer session (including audits). Audits in subjects in which the student has no previous experience will be evaluated at full credit value in determining course load. Audits taken as repetition of work previously accomplished are considered at one half of their value in calculating course loads. With the single exception of foreign language audits, all audit registrations must fall within the range of maximum permissible course loads.

Foreign students on F-1 and J-1 visas are required by the Immigration and Naturalization Service to carry a full-time course of study to remain in status.

Graduate students holding assistantships are restricted to the following maximum semester course loads: full time, 3 hours; three-quarters time, 6 hours; one-

half time, 9 hours; one-quarter time, 12 hours. External employment obligations of students on assistantships plus their assistantship obligations should not exceed these limits. Additionally, graduate assistants are limited to the following maximum totals of credit hours over the duration of their appointments:

<i>Assistantship Classification</i>	<i>Length of Appointment</i>	<i>Maximum Credit Hours</i>
Full time	9 months	6
Full time	12 months	9
3/4 time	9 months	12
3/4 time	12 months	16
1/2 time	9 months	18
1/2 time	12 months	24
1/4 time	9 months	24
1/4 time	12 months	30

SENIORS

A member of the senior class may, with prior approval of the Dean of the Graduate School, register for graduate credit in courses at the 400- and 500-levels as long as the combined graduate and undergraduate credit load is not more than 15 hours. Seniors with an accumulated grade point average of 3.2 or better in their major may enroll for a combined graduate and undergraduate credit load of 18 hours upon the recommendation of the student's advisor and approval by the department and the Graduate School. No more than six hours of graduate credit may be accumulated by a senior, and those graduate credits may not be applied toward the requirements for a baccalaureate degree. Courses at the 600-level are not ordinarily open to undergraduates, although occasional exceptions are made for senior honor students.

Seniors desiring to take courses for graduate credit should contact their major advisers who will forward appropriate requests to the Graduate Dean for approval.

AUDITS

Students wishing to audit courses must have the approval of their advisers and of the instructors teaching the courses. While auditors receive no course credit, they are expected to attend class regularly. The degree to which auditors must participate in class beyond regular attendance is optional with the instructors; any such requirements should be clearly explained to the auditors in writing at the beginning of the semester. An instructor who feels that an auditor has failed to fulfill the stipulated requirements is justified in marking "NR" (no recognition given for audit) on the grade report roll.

Tuition and Fees

A statement of tuition and fees is mailed to each preregistered student approximately 20 to 30 days before the beginning of any term. The statement must be returned with full payment or complete financial assistance information by the due date appearing on the statement. Normally the due date is approximately two

weeks before classes begin. Non-preregistered students are required to pay their tuition and fees at registration.

All students are responsible for tuition appropriate to their residence status unless payment is specifically provided by the terms of a fellowship, traineeship or assistantship.

SEMESTER RATE SCHEDULE—1985-86 ACADEMIC YEAR

RESIDENTS OF NORTH CAROLINA*

<i>Hours</i>	<i>Tuition</i>	<i>Required</i>	
		<i>Fees</i>	<i>Total</i>
0-Thesis	\$110	\$ 17	\$127
0-2	60	55	115
3-5	120	55	175
6-8	180	110	290
9+	240	165	405

NONRESIDENTS**

<i>Hours</i>	<i>Tuition</i>	<i>Required</i>	
		<i>Fees</i>	<i>Total</i>
0-Thesis	\$ 303	\$ 17	\$ 320
0-2	425	55	480
3-5	850	55	905
6-8	1,275	110	1,385
9+	1,700	165	1,865

SUMMER SESSION RATE SCHEDULE—1986

RESIDENTS OF NORTH CAROLINA

<i>Hours</i>	<i>Tuition and Required Fees</i>
0-Thesis	\$ 116
0-2	113
3-5	173
6-8	233
9+	293

NONRESIDENTS

<i>Tuition and Required Fees</i>
\$ 309
478
903
1,328
1,753

SPECIAL REGISTRATION AND FEES—1985-86 ACADEMIC YEAR

****Summer Research [GR 596S (master's candidates) or GR 696S (doctoral candidates)]*

For graduate students whose programs of work specify no formal course work during a summer session and who will be devoting full time to thesis research.

*For definition of in-state and out-of-state rates, see pp. 42-45.

**Under certain conditions, nonresident students who have been offered an assistantship, traineeship or fellowship may be eligible for reduced tuition rates.

***Assessed the 0-Thesis rate.

****Examination Only [GR 597 (master's candidates)]*

For graduate students in master's programs not requiring a thesis who have completed all requirements except the final oral examination by the beginning of the term in which the degree is to be awarded.

***Thesis Preparation Only [GR 598 (master's candidates) or GR 698 (doctoral candidates)]

For graduate students who have completed all course work, research and residence requirements and who are writing a thesis or dissertation.

****Dissertation Research* [GR 697 (doctoral candidates)]

For doctoral students who have scheduled no formal course work during a given term, who have passed the preliminary examinations, who have completed at least six hours of departmental research on the doctoral program and who are devoting full time to the dissertation. Students so registered are full-time; the course carries no credit hour designation.

Audits

During semester when registered and paying for other course work	One audit free, each additional audit same cost as for credit
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During semester when not registered
for other course work Same cost as for credit

During any summer session Same cost as for credit

Full-time Faculty or Staff \$7

Microfilming Doctoral Dissertation \$42****

Office of International Visitors

A special administrative management fee of \$200 per semester and \$100 per summer session is required from a contracting agency sponsoring international students who are programmed and advised by the University's Office of International Visitors.

(ALL CHARGES ARE SUBJECT TO CHANGE WITHOUT NOTICE)

FULL-TIME FACULTY AND EMPLOYEES

Full-time faculty of instructor rank and above and other full-time employees of the University who hold membership in the Teachers' and State Employees' Retirement System may register for credit or as auditors with free tuition privileges for one course in any academic term at any campus of the University of North Carolina. Free tuition privileges do not apply during the summer. Each applicant for free tuition must submit through regular channels a form provided by the University.

*** Assessed the 0-Thesis rate.

Effective 7-1-86

REFUND OF TUITION AND FEES

A student who officially withdraws from school during the first two weeks of a semester or by the end of the fourth day of a summer session will receive a tuition and fees refund of the full amount paid less a registration fee. The withheld fee amounts to \$15 the first week and \$25 the second week. After the two-week period, no refund will be made.

In some instances, circumstances justify the waiving of rules regarding refunds. An example might be withdrawal because of sickness. Students have the privilege of appeal to the Fee Appeals Committee when they feel special consideration is merited. Applications for such appeals may be obtained from the University Cashier and Student Accounts Office, 2 Peele Hall.

RESIDENCE STATUS FOR TUITION PURPOSES

The basis for determining the appropriate tuition charge rests upon whether a student is a resident or a nonresident for tuition purposes. Each student must make a statement as to the length of his or her residence in North Carolina with assessment by the institution of that statement to be conditioned by the following:

Residence—To qualify as a resident for tuition purposes, a person must become a legal resident and remain a legal resident for at least twelve months immediately prior to classification. Thus, there is a distinction between legal residence and residence for tuition purposes. Furthermore, twelve months' legal residence means more than simple abode in North Carolina. In particular, it means maintaining a domicile (permanent home of indefinite duration) as opposed to "maintaining a mere temporary residence or abode incident to enrollment in an institution of higher education." The burden of establishing facts which justify classification of a student as a resident entitled to in-state tuition rates is on the applicant for each classification, who must show his or her entitlement by the preponderance (the greater part) of the residentiary information.

Initiative—Being classified a resident for tuition purposes is contingent on the student's seeking such status and providing all information that the institution may require in making the determination.

Parents' Domicile—If an individual, irrespective of age, has living parent(s) or court-appointed guardian of the person, the domicile of such parent(s) or guardian is, *prima facie*, the domicile of the individual; but this *prima facie* evidence of the individual's domicile may or may not be sustained by other information. Further, nondomiciliary status of parents is not deemed *prima facie* evidence of the applicant child's status if the applicant has lived (though not necessarily legally resided) in North Carolina for the five years preceding enrollment or re-registration.

Effect of Marriage—Marriage alone does not prevent a person from becoming or continuing to be a resident for tuition purposes, nor does marriage in any circumstance insure that a person will become or continue to be a resident for tuition purposes. Marriage and the legal residence of one's spouse are, however, relevant information in determining residentiary intent. Furthermore, if both a husband and his wife are legal residents of North Carolina and if one of them has been a legal resident longer than the other, then the longer duration may be claimed by either spouse in meeting the twelve-month requirement for in-state tuition status.

Military Personnel—A North Carolinian who serves outside the State in the armed forces does not lose North Carolina domicile simply by reason of such service, and students from the military may prove retention of establishment of residence by reference, as in other cases, to residentiary acts accompanied by residentiary intent.

Grace Period—If a person (1) has been a bona fide legal resident, (2) has consequently been classified a resident for tuition purposes and (3) has subsequently lost North Carolina legal residence while enrolled at a public institution of higher education, that person may continue to enjoy the in-state tuition rate for a grace period of twelve months measured from the date on which North Carolina legal residence was lost. If the twelve months end during an academic term for which the person is enrolled at a State institution of higher education, the grace period extends, in addition, to the end of that term. The fact of marriage to one who continues domiciled outside North Carolina does not by itself cause loss of legal residence, marking the beginning of the grace period.

Minors—Minors (persons under 18 years of age) usually have the domicile of their parents, but certain special cases are recognized by the residence classification statute in determining residence for tuition purposes.

(a) If a minor's parents live apart, the minor's domicile is deemed to be North Carolina for the time period(s) that either parent, as a North Carolina legal resident, may claim and does claim the minor as a tax dependent, even if other law or judicial act assigns the minor's domicile outside North Carolina. A minor thus deemed to be a legal resident will not, upon achieving majority before enrolling at an institution of higher education, lose North Carolina legal residence if that person (1) upon becoming an adult "acts, to the extent that the person's degree of actual emancipation permits, in a manner consistent with bona fide legal residence in North Carolina" and (2) "begins enrollment at an institution of higher education not later than the fall academic term next following completion of education prerequisite to admission at such institution."

(b) If a Minor has lived for five or more consecutive years with relatives (other than parents) who are domiciled in North Carolina and if the relatives have functioned during this time as if they were personal guardians, the minor will be deemed a resident for tuition purposes for an enrolled term commencing immediately after at least five years in which these circumstances have existed. If under this consideration a minor is deemed to be a resident for tuition purposes immediately prior to his or her eighteenth birthday, that person on achieving majority will be deemed a legal resident of North Carolina of at least 12 months' duration. This provision acts to confer in-state tuition status even in the face of other provisions of law to the contrary; however, a person deemed a resident of 12 months' duration pursuant to this provision continues to be a legal resident of the State only so long as he or she does not abandon North Carolina domicile.

Lost but Regained Domicile—If a student ceases enrollment at or graduates from an institution of higher education while classified a resident for tuition purposes and then both abandons and reacquires North Carolina domicile within a 12-month period, that person, if he or she continues to maintain the reacquired domicile into re-enrollment at an institution of higher education, may re-enroll at the in-state tuition rate without having to meet the usual 12-month durational re-

quirement. However, any one person may receive the benefit of this provision only once.

Change of Status—A student admitted to initial enrollment in an institution (or permitted to re-enroll following an absence from the institutional program which involved a formal withdrawal from enrollment) must be classified by the admitting institution either as a resident or as a non-resident for tuition purposes prior to actual enrollment. A residence status classification once assigned (and finalized pursuant to any appeal properly taken) may be changed thereafter (with corresponding change in billing rates) only at intervals corresponding with the established primary divisions of the academic year.

Transfer Students—When a student transfers from one North Carolina public institution of higher education to another, he or she is treated as a new student by the institution to which he or she is transferring and must be assigned an initial residence status classification for tuition purposes.

Law—The controlling North Carolina statute concerning residence status classification for tuition purposes is G.S. 116-143.1. Copies of the applicable law and/or implementing regulations are available for inspection in the Office of Undergraduate Admissions, 112 Peele Hall.

To initiate a review of a residence status classification, a student must submit a Residence-and-Tuition Status Application to the Undergraduate Admissions Office. Questions about residency should be directed to that office.

CLASSIFICATION PROCEDURES

A. *Initial Classification*—A student admitted to initial enrollment in an institution (or permitted to re-enroll following an absence from the institutional program which involved a formal withdrawal from enrollment) shall be classified by the admitting institution either as a resident or as a nonresident, for tuition purposes, prior to actual matriculation. Particular officials or offices of the institution shall be designated to evaluate all such initial classification cases and to assign an appropriate classification consistent with the requirements of State law and the provisions of this manual. Basic data on which such assignment shall be based shall be collected in accordance with the common informational form prescribed in Appendix B of Residence Manual, 1973, as revised 7/74 and 7/75, NCSU; additional data or documentation deemed essential to a reliable determination may be elicited from the student, as deemed appropriate by the responsible official or office.

B. *Subsequent Classification Inquiries: Reclassification*—A residential classification once assigned (and confirmed pursuant to any appellate process invoked) may be changed thereafter only at intervals corresponding with the established primary divisions of the academic calendar of the institution, viz., at the beginning of a semester, quarter, or otherwise denominated basic interval of the academic calendar. No change in residential status for tuition purposes (and thus no change in applicable billing rates) shall be effected during such a semester, quarter, or term, with resulting increases or decreases in the tuition obligation on a pro rata basis for a portion of such semester, quarter or term.

The institution shall provide to each student at the time of and in connection with the transmission to him or her of each periodic bill for tuition charges a notice

of the circumstances under which and the time at which a change in classification may occur. The notice shall be of the type prescribed in Appendix C of the Residence Manual, July, 1973, as revised 7/74 and 7/75, NCSU.

Fellowships and Graduate Assistantships

Graduate students may receive financial support through fellowships, traineeships and teaching or research assistantships sponsored by federal, state and private agencies. Prospective students may request consideration for financial assistance by completing the appropriate sections of the admissions application form. Applicants for these awards should correspond directly with the department of major interest concerning the availability of awards and related information. Enrolled students should contact the major department. Prospective and enrolled graduate students are encouraged to apply for national, regional and foundation fellowships in addition to awards sponsored through the University.

The University offers approximately 1,600 assistantships each year. Stipend rates for teaching and research assistantships are competitive with other universities. For further information on the availability of assistantships, applicants should contact the program area of interest.

The out-of-state tuition differential will be paid for all U. S. citizens who are awarded teaching or research assistantships; the source of this payment will be either from monies made available to North Carolina State University by the Board of Governors for tuition remission, from research grants or from other sources obtained by North Carolina State University. Other non-resident students appointed to assistantships or to fellowships and traineeships may be considered for a special tuition rate. Further information may be obtained by contacting the Graduate School office or the department of major interest.

A graduate student must be in good academic standing (B or better average) to be eligible for appointment to an assistantship, fellowship or traineeship and must be registered in each semester in which the appointment is in effect.

SPONSORING AGENCIES

A partial listing of sponsoring agencies includes the following:

Agency for International Development	Association of Synthetic Yarn Manufacturers, Inc.
Air Force Office of Scientific Research	Avtex Fibers, Inc.
Allied Fibers and Plastics	Battelle
Alternative Energy Corporation	Becton-Dickinson
Aluminum Company of America	Biotechnology Center of North Carolina
American Chemical Society	Blythe Brothers Company
American Institute of Industrial Engineers	Boise-Cascade Corporation
American Lung Association	Bristol Myers
American Enka	Burlington Industries
Army Research Office	Burroughs Wellcome
Associated General Contractors	Carolina Power and Light Company

Carolina Tractor and Equipment
 Company
 Celanese Corporation
 Central Pharmaceuticals, Inc.
 Champion International
 Cities Service Foundation
 Cotton, Inc.
 Crown Zellerbach Foundation
 Department of Energy
 Department of Health and Human
 Services
 Department of Transportation
 Douglas Aircraft Company
 Dow Chemical Company
 Dreyfus Foundation
 Durham Corporation
 EAR Corporation
 E. I. DuPont de Nemours Company
 E. Sigurd Johnson
 Eastman Kodak Company
 Environmental Protection Agency
 Ford Foundation
 Ford Motor Company
 General Electric Corporation
 General Foods Corporation
 Gifford-Hill and Company
 Glass Packaging Institute
 Goodyear Tire and Rubber Company
 Harry B. Gilbert
 Hercules, Inc.
 Hercules Powder Company
 Institute of Nuclear Power Operations
 Institute of Transportation Research
 and Education
 Intel Corporation
 International Business Machines
 International Forest Seed Company
 International Institute of Education
 International Nickel Corporation
 International Paper Company
 International Potato Center
 ITT Rayonier Foundation
 Kamphoefner Honor
 Lockheed Aircraft
 Marine Colloids Institute
 Marine Science Development Grants
 Martin-Marietta Aggregates

Mary Lee and Luther Barnhardt
 Memorial Scholarship
 Materials Handling Institute
 Microelectronics Center of N. C.
 Minnesota Mining and Manufacturing
 Monsanto Chemical Company
 National Aeronautics and Space Ad-
 ministration
 National Center for Health Services
 Research
 National Institute of Occupational
 Safety and Health
 National Institute on Aging
 National Institutes of Health
 National Science Foundation
 National Science Teachers Association
 N.C. Agricultural Foundation
 N.C. Board of Science and Technology
 N.C. Chapter of the American Society
 of Landscape Architects
 N.C. Chapter of the Soil Conservation
 Society of America
 N.C. City-County Manager's
 Association
 N.C. Dairy Foundation
 N.C. Department of Administration
 N.C. Department of Commerce
 N.C. Department of Community
 Colleges
 N.C. Department of Crime Control
 and Public Safety
 N.C. Department of Human Resources
 N.C. Department of Natural and
 Economic Resources
 N.C. Energy Institute
 N.C. Garden Club
 N.C. Marine Science Council
 N.C. State Board of Education
 N.C. State University Alumni
 Association
 N.C. State University Alumni
 Association Fellowship in University
 History
 N.C. Textile Foundation
 N.C. Tobacco Foundation
 O'Brien/Atkins Associates
 Occidental

Office of Naval Research
 Office of Water Research and
 Technology
 Owens-Corning Fiberglass
 Corporation
 Partitions, Inc.
 Pfizer, Inc.
 Philip-Morris
 Phillips Petroleum Company
 PHS National Institute of Mental
 Health
 Physics International Company
 Plastics Institute of America
 Proctor and Gamble
 Pulp and Paper Foundation, Inc.
 Remington Arms Company
 R. J. Reynolds Tobacco Company
 Ready-Mixed Concrete Company
 Research Corporation—Cottell
 Research Grants Program
 Research Triangle Institute
 Resources for the Future
 Reynolds Institute
 Reynolds Metals Company
 Rockefeller Foundation
 Sam Lynch Associates
 Science Applications, Inc.
 Sea Grant
 Selenium-Tellurium Development
 Association, Inc.
 Shell Companies Foundation
 The Sherwin-Williams Company
 Signal One Corporation
 Six Associates
 Smith-Richardson Foundation/
 Hudson Institute
 Society of Manufacturing Engineers
 Solar Energy Research Institute

Southeastern Association of Game
 and Fish Commissions
 Southeastern Cooperative Fish and
 Game Statistics Project
 Southeastern Gas Association
 Southern Furniture Manufacturers
 Association
 Southern Solar Energy Consortium
 Tau Beta Pi
 Union Carbide Corporation
 U.S. Agency for International
 Development
 U.S. Army
 U.S. Department of Agriculture
 U.S. Department of Commerce
 U.S. Department of Defense
 U.S. Department of Drug Ad-
 ministration
 U.S. Department of Education
 U.S. Department of Housing and
 Urban Development.
 U.S. Department of the Interior
 U.S. Department of Labor
 U.S. Department of Transportation
 U.S. Forest Service
 U.S. Public Health Service
 The University of North Carolina Sea
 Grant Program
 The W. K. Kellogg Foundation
 Walker Martin
 Water Resources Research Institute
 Western Electric Company
 Westvaco Corporation
 Weyerhaeuser Company
 William H. Deitrick
 Woods Hole Oceanographic
 Institution.

MINORITY PRESENCE GRANT PROGRAM

Under the Board of Governors general Minority Presence Grant Program, black students may be eligible for special financial assistance if they are residents of North Carolina, enrolled for at least three hours of degree-credit course work and demonstrate financial need.

The Minority Presence Grant Program for Doctoral Study, Law and Veterinary Medicine provides stipends of up to \$4,000 for the academic year, with an option of

\$500 in additional support for study in the summer sessions, for black residents of North Carolina who are selecte to participate. Recipients must be full-time students pursuing doctoral degrees, law degrees or degrees in veterinary medicine at East Carolina University, North Carolina State University, The University of North Carolina at Chapel Hill or The University of North Carolina at Greensboro.

Other Financial Aid

LONG-TERM LOANS

National Direct Student Loans (Formerly National Defense Student Loans): Graduate students who are American citizens or eligible noncitizens may apply to the Financial Aid Office for consideration for long term, low interest loans. To qualify for loans, students must be making satisfactory academic progress and must show financial need. The Financial Aid Form is the proper form to be completed for financial aid consideration. Other required forms—a Student Data Sheet and Financial Aid Transcript if needed—should be requested along with the FAF from the University's Financial Aid Office. Students are expected to apply for and to accept any available assistantships before applying for loans. In the event that the funds available through the Financial Aid Office are insufficient to meet the need of all students who apply and are eligible, priority for these loans will be given to students working on their first undergraduate degree and graduate students will be referred to other programs (see Guaranteed Student Loans).

Graduate students may borrow up to \$12,000 inclusive of any undergraduate National Direct Student (National Defense Student) Loans. There is no interest on the loan while the borrower is a full- or half-time student at an institution of higher education. Six months after ceasing to be at least a half-time student, interest begins at five percent per year. The repayment period begins at the same time. A ten-year repayment period is possible for large indebtedness; however, a minimum payment of \$30 per month is required. Interest does not accrue and repayment installments may be postponed during any period not in excess of three years during which the borrower is a member of the Armed Forces of the United States or is a Peace Corps or Vista volunteer. Reduction of obligations to repay may result from teaching in schools with high concentrations of low income families or from teaching handicapped children. New legislation also provides that the Defense Department may repay a portion of your loan if you serve as an enlisted person in certain military occupations after receiving an NDSL.

Institutional Long Term Loans: These loans are made from University funds. Institutional loans are made and are to be repaid under the same terms as the National Direct Student Loans except that there are no forgiveness features.

NOTE: Due to a lack of sufficient funds for all students, priority for National Direct Student Loans and Institutional Loans will be given to undergraduate students.

Guaranteed Student Loan Program: This program provides loans from private lenders. Procedures are different in each state. Information for available loans may be obtained in the Financial Aid Office. Interest is at eight percent per year with the Federal Government paying the interest during the in-school period. To be

eligible for this loan and the interest benefits, the total of the student's and the parents' (if applicable) adjusted gross income must be less than \$30,000 for the year prior to the academic year for which the loan is being requested. When the income exceeds \$30,000, the family must demonstrate financial need based on guidelines issued by the Department of Education in order to be eligible for the loan.

Legal residents of North Carolina who are enrolled in a degree program may borrow under the Guaranteed Student Loan Program through College Foundation, Inc., a maximum of \$5,000 per academic year or the total cost of education less other financial aid (including assistantships and fellowships), whichever is less. A maximum of \$25,000 may be borrowed for *all* undergraduate and graduate school Guaranteed Student Loans. College Foundation Loans are insured by the North Carolina Education Assistance Authority or the United States Department of Education. Students from other states may obtain information about similar plans from the Financial Aid Office.

PART-TIME JOBS

The College Work Study Program is a federal program designed to provide part-time jobs to students who show need of financial assistance. The same application, the Financial Aid Form, is used to apply for both loans and jobs. Effort is made to assign students to jobs in keeping with their special interests and skills. As is the case with campus-administered loans, priority for these funds is given to undergraduate students pursuing their first undergraduate degree.

Other jobs not based on need are listed at the Financial Aid Office and are open to all students.

SHORT-TERM EMERGENCY LOANS

Loans, usually in amounts of \$100 or less, to meet emergency expenses may be obtained on short notice at the Financial Aid Office. These loans, in that they are designed for short term, emergency use, must be repaid within about 30 days. A loan may not be taken out between semesters or summer sessions.

Military Education and Training

The Reserve Officer Training Corps (ROTC) selects interested University students for enrollment in Army ROTC (AROTC) or in Air Force ROTC (AFROTC) for officer education and training leading toward a commission.

The Army and Air Force ROTC departments educate and train University students, graduate and undergraduate, for a commission in their respective military services. These students must have four full semesters (undergraduate or graduate) remaining at the time they enter the ROTC Program (exceptions for Army ROTC are noted below). Uniforms and books for ROTC are provided. Transfer credit is allowed for previous ROTC course work at other institutions.

Graduate students who will be at NCSU for at least two years may, upon successful completion of a six-weeks' summer training period, be enrolled in the Air Force ROTC Program. Entry requirements for either program may also be met by having met any *one* of the following requirements:

1. Completed basic level ROTC courses as an undergraduate.
2. Be an honorably discharged veteran.
3. Have completed military basic training and be a member of an Army/Air Force Reserve or National Guard Unit.
4. Successfully complete a two-weeks, on-campus program (Army ROTC only).

Air Force ROTC offers a Flight Screening Program for selected cadets which is conducted by an Air Force flying school in Texas during the summer at no expense to the student. Students successfully completing ROTC flight screening may be selected for further flight training as an Air Force pilot.

Graduate students enrolled in the junior and senior years of ROTC receive \$100 per month. Scholarships which pay all tuition, fees and costs of required textbooks in addition to the \$100 per month are available on a competitive basis.

Special provisions for veterans are made in Army ROTC whereby they are granted placement credit for their prior service experience and training. Additionally, Army ROTC offers the student several points of entry into the ROTC Program, under a process of granting ROTC placement credit for college courses or other worthwhile experiences that contribute to the requisite skills of a second lieutenant. Army ROTC counselors are available to evaluate the students' prior learning experiences and advise them as to where they can be placed in ROTC. Under the Army's Simultaneous Membership Program, the graduate student may participate in the Army Reserve or National Guard and receive approximately \$84 per month in addition to the \$100 monthly stipend. The National Guard provides up to \$500 tuition costs per year for its members. The student must enlist in the specified component and have completed basic training prior to entry into the program.

Additional information on Army ROTC may be obtained from the Professor of Military Science, Room 154, Reynolds Coliseum (737-2428) and Air Force ROTC from the Professor of Aerospace Studies, Room 145, Reynolds Coliseum (737-2417).

Health Services

The Student Health Service, located in Clark Hall Infirmary, offers health care to students on an outpatient and inpatient basis. The facility is staffed by seven full-time physicians, four Family Nurse Practitioners, a pharmacist, registered nurses, laboratory technicians, health educators and support staff.

During fall and spring semester, the Health Service is open 24 hours a day, seven days a week. Outpatient hours only are observed during semester breaks and summer sessions. Physicians maintain regular office hours Monday through Friday and are on call at other times to assist the nurses on duty when the condition of a patient warrants immediate attention.

All currently enrolled students are eligible for medical care. The student health fee covers professional services both outpatient and inpatient; *i.e.*, visits to staff nurses and physicians, laboratory tests and X-rays performed in the Student Health Service. There is a nominal charge for x-rays and for certain medications, lab tests and inpatient care.

The University annually offers students the opportunity to enroll in a student group health and accident insurance plan which provides for the cost of referrals to off-campus specialists or to local hospitals for surgery and serious illnesses.

International students are required to enroll in a student health insurance program.

Housing

ON-CAMPUS HOUSING

The University operates 19 residence halls for single students with a total capacity to accommodate approximately 6,300 students. Eight of the halls are arranged in suites of four or five rooms with a common bathroom. Ten others have rooms which open onto a central corridor with bathrooms at separate intervals. North Hall has private baths in each double room.

Room are provided with basic furnishings such as bed, chest of drawers, desk, chair and waste basket for each double or single room occupant. An optional linen rental service is available through the University Laundry and Dry Cleaning Service.

The 1985-86 rental fee for a main campus residence hall double room is \$560 per semester per student and may increase in future years. Room rents in North Hall and South Hall are higher. With the exception of Watauga Hall (graduate and upper class residence hall), new freshmen and continuing residents have priority for a room assignment over new graduate students. Students who are unable to secure on-campus housing before school begins may contact the Student Assignments Office, 201 Harris Hall, on or after September 17 concerning the availability of housing on campus at that time.

OFF-CAMPUS HOUSING

The Student Assignments Office also maintains a self-help facility which makes available listings of off-campus housing accommodations sent to them by private landlords; however, specific arrangements for this housing must be contracted for by those individuals concerned. The listings are not mailed as they change frequently and most landlords and tenants prefer to complete the rental transaction in person rather than by telephone or mail. The Student Assignments Office is open from 8:00 a.m. until 5:00 p.m., Monday through Friday only.

MARRIED STUDENT HOUSING

The University also maintains 300 apartments for married students, including efficiency, one-bedroom and two-bedroom units. The monthly rental rates for the 1985-86 year are \$192 (includes gas) for efficiencies, \$185 for one-bedroom apartments and \$205 for the two-bedroom units. All apartments have built-in dresser drawers, closets, a stove and a refrigerator. Interested students should write to E. S. King Village, P Building, North Carolina State University, Raleigh, NC 27607 for family housing applications and information or telephone (919) 737-2430.

Additional Information

If additional information is needed, contact the Graduate School, 104 Peele Hall, P. O. Box 7102, North Carolina State University, Raleigh, N.C. 27695-7102 (telephone 919/737-2871).

GRADUATE PROGRAMS

The Graduate School offers programs of study leading to the master's degree in 75 fields and the doctorate in 48. Each student's program is planned with an advisory committee of graduate faculty members to provide the opportunity for gaining advanced knowledge in the particular field of study. Graduate education is the final stage in the development of intellectual independence. It is different from undergraduate education in that the student is encouraged to establish premises, to hypothesize and to defend both the procedure and the conclusions of independent investigation. The burden of proof for the verifiability of knowledge rests on the student, not on the faculty member. Emphasis is placed upon the student's scholarly development through formal course work, seminars, research and independent investigation.

Graduate students are expected to familiarize themselves with the requirements for the degrees for which they are candidates and are held responsible for the fulfillment of these requirements.

Master's Degrees

The Graduate School offers programs of study leading to the Master of Science degree, the Master of Arts degree and the Master's degree in certain designated fields.

MASTER OF SCIENCE AND MASTER OF ARTS

For all Master of Science and Master of Arts degrees, the programs are planned with the objective of making possible a reasonable, comprehensive mastery of the subject matter in the chosen field. Training and experience in research are provided to familiarize the student with the methods, ideals and goals of independent investigation.

The Master of Science degree is awarded in the following fields:

Adult and Community College Education	Ecology
Aerospace Engineering	Educational Administration and Supervision
Agricultural Economics	Electrical and Computer Engineering
Agricultural Education	Entomology
Animal Science	Food Science
Applied Mathematics	Forestry
Biochemistry	Genetics
Biological and Agricultural Engineering	Guidance and Personnel Services
Biomathematics	Horticultural Science
Botany	Industrial Arts Education
Chemical Engineering	Industrial Engineering
Chemistry	Management
Civil Engineering	Marine, Earth and Atmospheric Sciences
Computer Studies	
Crop Science	
Curriculum and Instruction	

Materials Engineering
 Mathematics
 Mathematics Education
 Mechanical Engineering
 Microbiology
 Middle Grades Education
 Nuclear Engineering
 Nutrition
 Occupational Education
 Operations Research
 Physics
 Physiology
 Plant Pathology
 Poultry Science
 Psychology

Recreation Resources
 Administration
 Rural Sociology
 Science Education
 Soil Science
 Special Education
 Statistics
 Textile Chemistry
 Textile Engineering and Science
 Textile Management and Technology
 Toxicology
 Veterinary Medical Sciences
 Vocational Industrial Education
 Wildlife Biology
 Wood and Paper Science
 Zoology

The Master of Arts degree is offered in Archival Management, Economics, English, History and Political Science.

ADVISORY COMMITTEE AND PLAN OF GRADUATE WORK

The advisory committee is composed of at least three members of the Graduate Faculty, one of whom is designated as the chair and one of whom represents the supporting area. This committee is appointed by the Graduate Dean upon the recommendation of the head of the major department.

The student's program of study is planned so as to provide a comprehensive view of the major field of interest and to provide training in research in this field and related areas of knowledge. As great a latitude is permitted in the selection of courses as is compatible with a well-defined major and supporting courses. In general, it is expected that approximately two-thirds of the course work will be in the major and one-third in supporting courses. Since there are many possible combinations of course work, a specific Plan of Graduate Work is developed by the advisory committee with the student. The program of course work to be followed by the student and the thesis problem selected must be approved by the student's advisory committee, the head of the department and the Graduate School. The Plan of Graduate Work should be submitted to the Graduate School for approval prior to completion of one-half of the program.

RESIDENCE

Students engaged in a course of study leading to the Master of Science or Master of Arts degree are required to be in residence, pursuing graduate work, for a minimum of one full academic year or its equivalent.

CREDITS

A minimum of 30 semester credits is required for the Master of Science or Master of Arts; however, the number of credit hours included in a Plan of Graduate

Work often exceeds this minimum. At least 20 semester hours must come from 500- and 600-level courses, with no fewer than six credits being at the 600-level. The program may include no more than six hours of research and no more than two hours of departmental seminar, unless the total program exceeds 30 hours. Courses at the 400-level counted toward the minimal 30-hour requirement may not come from the major field.

CREDIT FROM OUTSIDE SOURCES

1. Generally, no more than six of the required academic credits will be accepted from other institutions. A graduate course may be considered for transfer to a master's program provided it has been completed in a graduate or post-baccalaureate classification at an accredited graduate school with a grade of "B" or better. Transfer credit may not be used to fill the 600-level course requirement in master's programs.
2. No graduate credit will be allowed for excess credits completed in an undergraduate classification at another institution.
3. No graduate credit will be allowed for correspondence courses.
4. A maximum of six semester credits earned through North Carolina State University Extension study may be applied toward degree requirements provided the courses are graduate level and are taught by members of the University graduate faculty. Transfer credit is not granted for courses taken by extension at other institutions. If a student has been admitted to the Graduate School and an approved Plan of Graduate Work has been submitted, six additional semester credits may be obtained in off-campus North Carolina State University graduate courses to apply toward the minimal credit hour requirement for the degree. Credit accepted by extension reduces the amount of credit which may be transferred from other institutions.

GRADING AND ACADEMIC STANDING

Performance in lecture courses is evaluated as "A" (Excellent), "B" (Good), "C" (Passing), "D" or "NC" (No credit). In order to receive graduate degree credit, a grade of "C" or higher is required. All grades on courses taken for graduate credit as an undergraduate at NCSU and all grades on courses taken in a graduate classification at NCSU in courses numbered 400 and above are included in the graduate grade point average. Courses at the 300 level and below are not considered for graduate credit and grades earned on them do not enter the grade point average.

Performance in research, seminar and special problems courses is evaluated as either "S" (Satisfactory) or "U" (Unsatisfactory), and these grades are not used in computing the grade point average. However, a student who receives a "U" on any course will not receive credit for that course and may be required to repeat it.

The "Master Listing of Approved Graduate Courses" identifies the approved grading (A,B,C,D,NC or S,U) for each 500- and 600-level course. Any deviation from the approved grading for a particular course must be requested by the department and approved by the Academic School Dean and the Graduate Dean prior to teaching the course.

The grade of "IN" (Incomplete) may be given in any course at the discretion of the instructor. A student who receives an "IN" must complete the unfinished work to have the Incomplete converted to a final grade by the end of the next semester in which the student is enrolled provided that this period is not longer than 12 months from the end of the semester or summer session in which the Incomplete Incomplete was received; otherwise, the "IN" will be automatically converted to "NC" or "U," in accord with the grading approved for the particular course. All grades of "IN" must be cleared prior to graduation.

Except in the case of Interinstitutional Registration (see p. 38), grades on courses transferred from another institution will not be included in computing the grade point average.

Graduate students are given a notice of academic warning if they have accumulated less than nine hours at the 400-level or above and have less than a 3.0 ("B" average). Graduate students are placed on academic probation if they accumulate nine or more but less than eighteen credit hours at the 400-level or above and have a grade point average of less than 3.0 ("B" average). A student's graduate study is terminated if eighteen or more credit hours at the 400-level or above are accumulated with a grade point average of less than 3.0 ("B" average). In the case of program termination, no further registration in a graduate classification will be permitted. Under extenuating circumstances the student will be reinstated upon the written recommendation of the department and approval by the Graduate Dean. (Effective Fall 1978 for all graduate students.) Departments have the prerogative of recommending the termination of a student's graduate admission at any time.

Students who are eligible to attend the first summer session are eligible to attend either or both summer sessions. For example, students who receive a notice of "Graduate Admission Terminated" at the end of the first summer session may register for the second summer session unless the major department recommends otherwise.

A graduate student must be in good academic standing (B or better average) to be eligible for appointment to an assistantship, fellowship or traineeship and must be registered in each semester in which the appointment is in effect.

LANGUAGE REQUIREMENTS

A reading knowledge of one modern foreign language (Germanic, Romance or Slavic) is required of students pursuing the Master of Arts in English and of students engaged in the Master of Science programs in chemistry and mathematics. In the Master of Arts program in political science, competence in a foreign language or in research methodology is required. The Departments of Entomology, History and Mathematics and Science Education leave the decision to the student's advisory committee.

Proficiency can be demonstrated in one of two ways:

1. By passing a traditional reading knowledge examination, which can be requested by the student at any time.
2. By passing the final examination in a course especially designed for graduate students who have no previous knowledge of a foreign language or who wish

to refresh their knowledge of a language. The Department of Foreign Languages and Literatures offers such courses, normally in the fall, for each of the three major foreign languages: French (FLF 401), German (FLG 401) and Spanish (FLS 401). These courses concentrate exclusively on teaching students to understand the written word and do not provide instruction or testing in speaking and original composition. Failure to pass the course carries with it no penalty other than the fact that the student's language requirement will remain unfulfilled. These courses are neither counted for credit nor used in computing the grade point average.

THESIS

Theses prepared by candidates for the Master of Science or Master of Arts degree must represent an original investigation into a subject which has been approved by the student's advisory committee and the head of the major department. Three copies of the thesis in final form as approved by the advisory committee, each signed by the members of the advisory committee, must be submitted to the Graduate School by a specific deadline in the semester or summer session in which the degree is to be conferred. Detailed information on form and organization of the thesis is presented in the University's *Guide for the Preparation of Theses*, which is available in the Graduate School office.

COMPREHENSIVE WRITTEN EXAMINATIONS

Written examinations covering the subject matter of the major and supporting fields may be required of the candidate. When required, such examinations must be successfully completed prior to requesting the comprehensive oral examination. Information concerning written examination schedules should be obtained from the student's major department.

COMPREHENSIVE ORAL EXAMINATIONS

A candidate for the Master of Science or Master of Arts degree must pass a comprehensive oral examination to demonstrate to the advisory committee that he or she possesses a reasonable mastery of the subject matter of the major and supporting fields and that this knowledge can be used with promptness and accuracy. This examination may not be held until all other requirements, except completion of the course work for the final semester, are satisfied. Application for the examination must be filed with the Dean of the Graduate School by the chair of the advisory committee at least two weeks prior to the date on which the examination is to be held and must be accompanied by certification that the thesis is complete except for such revisions which may be necessary as a result of the final examination.

A unanimous vote of approval by the advisory committee is required for passing the oral examination. Approval of the examination may be conditioned, however, upon the completion of additional work to the satisfaction of the advisory committee. A formal reexamination will not be required in this case. Failure of a student to pass the oral examination terminates the student's graduate work at this institu-

tion unless otherwise unanimously recommended by the advisory committee. Only one reexamination will be permitted. All committee actions may be appealed by written application to the Graduate Dean.

Oral examinations for master's degree candidates are open to the graduate faculty by right and to the University community by unanimous consent of the advisory committee and the student being examined. Discussions and decisions regarding the student's performance are private to the advisory committee.

TIME LIMIT

All requirements for the master's degree must be completed within six calendar years, beginning with the date the student commences courses carrying graduate credit applicable to the degree program, unless a more restrictive time limit has been established by the academic school.

MASTER'S DEGREE IN A DESIGNATED FIELD

The University offers a number of master's degree programs in designated fields. The degree offerings are listed below. These programs vary in requirements and persons having an interest in these programs are advised to contact the major department for further information including specific prerequisites and degree requirements. General Graduate School policies as stated on page 44 through 49 apply to these degree programs with the exception of references to the master's thesis.*

Following is a listing of the degrees that may be awarded upon the completion of the course of study in a designated field:

Master of Agriculture	Master of Technology for
Master of Architecture	International Development
Master of Biological and	Master of Landscape Architecture
Agricultural Engineering	Master of Life Sciences
Master of Biomathematics	Master of Materials Engineering
Master of Chemical Engineering	Master of Mechanical Engineering
Master of Chemistry	Master of Nuclear Engineering
Master of Civil Engineering	Master of Product Design
Master of Computer Studies	Master of Public Affairs
Master of Economics	Master of Recreation Resources
Master of Education**	Master of Sociology
Master of Electrical Engineering	Master of Statistics
Master of Engineering***	Master of Textiles
Master of Forestry	Master of Toxicology
Master of Industrial Engineering	Master of Urban Design****
Master of Integrated Manufacturing	Master of Wildlife Biology
Systems Engineering	Master of Wood and Paper Science

*Students in programs leading to the Master of Education degree may elect a thesis option or they may complete the course "Introduction to Educational Inquiry" or a departmental course in research and a problem report.

**The following programs in the School of Education offer courses of study leading to the Master of Education degree: adult and community college education, agricultural education, curriculum and instruction, educational administration and supervision, guidance and personnel services, industrial arts education, mathematics education, middle grades education, occupational education, science education, special education and vocational industrial education.

***Off-campus only.

****No new applications are being accepted. Students interested in this area should contact the School of Design.

Summary of Procedures for Master's Degrees

1. Letter of inquiry from prospective student to Graduate School or department head.
2. Mailing of proper forms to student.
3. Receipt of application materials and required fee.
4. Review of application materials by department or program.
5. Department forwards recommendation regarding applicant's admissibility to Graduate Dean.
6. The department's recommendation is reviewed and the student is notified of the action taken on the request for admission.
7. Student arrives, reports to the department, is assigned an adviser and makes out a roster of courses in consultation with the departmental adviser.
8. Advisory committee of three or more graduate faculty members, one of whom is designated as the chair and one of whom represents the supporting field, appointed by the Graduate Dean upon the recommendation of the department head.
9. Plan of Work prepared by the advisory committee with the student and submitted in quadruplicate to the department head and the Graduate School for approval prior to completion of one-half of the proposed program.
10. Three copies of the approved Plan of Work returned to the department. One copy is kept in department files, one is returned to the committee chair and one is given to the student.
11. Student passes language examination (if required by the major department).
12. Written examination in the major and/or supporting fields may be required of the candidate. If required, written examinations must be successfully completed prior to requesting the comprehensive oral examination.
13. A copy of a preliminary draft of the thesis is submitted to the chair of the student's advisory committee for review. (Thesis degrees only).
14. The diploma order request form must be filed with the Graduate School by the end of the third week of the semester or summer session of anticipated graduation. Failure to submit the form by this date may result in the student's not receiving the diploma at graduation.
15. At least two weeks prior to the final oral examination, the chair of the student's advisory committee submits the thesis to advisory committee members for review. (Thesis degrees only).
16. The final oral examination may be scheduled when all other requirements, except completion of the course work for the final semester, are satisfied. Permission for the candidate to take the final oral examination is requested of the Graduate School at least two weeks before the examination and, in the case of thesis degrees, must be accompanied by a certification that the thesis is complete except for such revisions as may be necessary as a result of the final examination. Specific deadline dates for non-thesis master's candidates appear in The Calendar.
17. The Graduate Dean schedules the examination and notifies the student and advisory committee of the time and place. The report on the final examination should be filed with the Graduate School as soon as the examination has been completed.

18. Three copies of the thesis signed by each member of the student's advisory committee must be submitted to the Graduate School by a specific deadline in the semester or summer session in which the degree is to be conferred. Specific deadline dates appear in *The Calendar*.
19. The thesis is reviewed by the Graduate School to insure that the format conforms with the specifications prescribed in the *Guide for the Preparation of Theses*. (Thesis degrees only).
20. All course work scheduled in a graduate degree classification must be completed prior to graduation.
21. A grade point average of at least 3.0 is required for graduation.
22. All degree requirements must be completed within six calendar years, beginning with the date the student commences courses carrying graduate credit applicable to the degree program, unless a more restrictive time limit has been established by the academic school.

Doctor of Philosophy and Doctor of Education Degrees

The doctorate symbolizes the ability of the recipient to undertake original research and scholarly work at the highest levels without supervision. The degree is therefore not granted simply upon completion of a stated amount of course work but rather upon demonstration by the student of a comprehensive knowledge and high attainment in scholarship in a specialized field of study. The student must demonstrate this ability by writing a dissertation reporting the results of an original investigation and by passing a series of comprehensive examinations in the field of specialization and related areas of knowledge.

The Doctor of Philosophy degree is offered in the following fields of study:

Aerospace Engineering	Horticultural Science
Animal Science	Industrial Engineering
Applied Mathematics	Marine, Earth and Atmospheric Sciences
Biochemistry	Materials Engineering
Biological and Agricultural Engineering	Mathematics
Biomathematics	Mathematics Education
Botany	Mechanical Engineering
Chemical Engineering	Microbiology
Chemistry	Nuclear Engineering
Civil Engineering	Nutrition
Crop Science	Operations Research
Economics	Physics
Electrical and Computer Engineering	Physiology
Entomology	Plant Pathology
Fiber and Polymer Science	Psychology
Food Science	Science Education
Forestry	Sociology
Genetics	Soil Science

Statistics
Toxicology
Veterinary Medical Sciences

Wood and Paper Science
Zoology

The Doctor of Education degree is offered in the following fields:

Adult and Community College Education	Guidance and Personnel Services
Curriculum and Instruction	Industrial Arts Education
Educational Administration and Supervision	Occupational Education

ADVISORY COMMITTEE AND PLAN OF GRADUATE WORK

An advisory committee of at least four graduate faculty members, one of whom will be designated as chair, will be appointed by the Dean of the Graduate School upon the recommendation of the head of the major department. The committee, which must include at least one representative of the minor field, will, with the student, prepare a Plan of Graduate Work which must be approved by the department head and the Graduate School. In addition to the course work to be undertaken, the subject of the student's dissertation must appear on the plan; and any subsequent changes in subject or in the overall plan must be submitted for approval.

The program of work must be unified, and all constituent parts must contribute to an organized program of study and research. Courses must be selected from groups embracing one principal subject of concentration, the major, and from a cognate field, the minor. Normally, a student will select the minor work from a single discipline or field which, in the judgment of the advisory committee, provides relevant support to the major field. However, when the advisory committee finds that the needs of the student will best be served by work in an interdisciplinary minor, it has the alternative of developing a special program in lieu of the usual minor.

RESIDENCE REQUIREMENT

For the Doctor of Philosophy and the Doctor of Education degrees, the student is expected to be registered for graduate work at an accredited graduate school for at least six semesters beyond the baccalaureate degree.

The basic University residence requirements are defined below. However, academic schools have the prerogative of establishing more restrictive requirements within the respective schools. (The School of Education requires a minimum of one academic year of full-time resident study).

At least two residence credits, as defined below, must be secured in continuous residence (registration in consecutive semesters) as a graduate student at the University. Failure to take work during the summer does not break continuity; however, summer work may be used in partial fulfillment of this requirement.

Residence credit is determined by the number of semester hours of graduate work carried during a given term. During a regular semester, residence credit is calculated in the following manner:

<i>Semester Credits (Hours)</i>	<i>Residence Credits</i>
9 or more	1
6-8	2/3
less than 6 (including registration for "Thesis Preparation")	1/3

The residence credit for a six-week summer term is equal to one-half of the corresponding amount for a regular semester. For example, six semester hours carried during a summer session will earn one-third of a residence credit; less than six credit hours will earn one-sixth of a residence credit.

GRADING AND ACADEMIC STANDING

The grading system and grade requirements for all doctoral programs are the same as those for master's degree programs, as described on pages 55-56.

LANGUAGE REQUIREMENTS

A reading knowledge of at least one modern foreign language is required by some departments for the Doctor of Philosophy degree. Doctoral students should contact the major department for specific language requirements. For the Doctor of Education degree, the decision as to whether or not there will be a language requirement is left to the student's advisory committee.

Students who choose to demonstrate a reading knowledge of a language may select from any of the Romance, Germanic or Slavic languages (or any combination in those programs requiring two languages). The Department of Foreign Languages and Literatures offers courses in French, German and Spanish especially designed for graduate students who have no previous knowledge of a foreign language or who wish to refresh their knowledge of a language. These courses concentrate exclusively on teaching students to understand the written word and do not provide instruction or testing in speaking and original composition. A passing grade on the final examination in one of these courses is sufficient evidence of a reading knowledge of the language.

To demonstrate comprehension in depth of one language, a student must not only prove that one possesses a reading knowledge of the language but also that he or she is proficient in the oral and compositional elements of that language. Students desiring to master one language in depth should consult the head of the Department of Foreign Languages and Literatures concerning the specific courses which will be necessary to achieve this comprehension; specific arrangements will depend upon the student's background in the language.

Students whose native language is other than English may use English as one of the languages when two are required for the Doctor of Philosophy degree. When English is submitted in partial fulfillment of the dual language requirement, the native language may not be used as the other language.

When only one language is required in the student's program, certification for that language must occur on this campus.

PRELIMINARY COMPREHENSIVE EXAMINATIONS

After completing the language requirement but not earlier than the end of the second year of graduate study and not later than one semester (four months) before the final oral examination, each doctoral student is required to take the preliminary comprehensive examinations. The examinations consist of two parts: written examinations and an oral examination. Requirements for written examinations in the minor field are left to the discretion of the department in which the student is minoring.

The written portion may be conducted in one of two ways. In the first, each member of the advisory committee prepares a set of questions for the student's response, and answers to each set are returned to the appropriate member for grading. This procedure is used by departments which have a relatively small number of doctoral students.

Many of the larger departments have developed departmental written examinations to be used for all students. These examinations are given several times during the year, and scheduled dates are announced well in advance. Where written departmental examinations of this kind are used, the student will be expected to make arrangements to schedule these examinations.

Regardless of the method employed, the questions involved may cover any phase of the course work taken by the student during graduate study or any subject logically related to an understanding of the subject matter in the major and minor areas of study. The questions are designed to measure the student's mastery of the subject matter and the adequacy of preparation for research. Failure to pass the written preliminary examinations terminates the student's work at this institution, subject to departmental and/or school policies with respect to reexamination.

Upon satisfactory completion of the written portion of the preliminary examinations and with no more than three uncompleted courses remaining on the approved program, authorization for the preliminary oral examination is requested from the Graduate School. This examination is conducted by the student's advisory committee and a representative from the Graduate School and is open to all graduate faculty members. The student and the examining committee will be notified by the Graduate School of the arranged time and place. The oral examination is designed to test the student's ability to relate factual knowledge to specific circumstances, to use this knowledge with accuracy and promptness and to demonstrate a comprehensive understanding of the field of specialization and related areas.

A unanimous vote of approval by the members of the advisory committee is required for the student to pass the preliminary oral examination. Approval may be conditioned, however, on the successful completion of additional work in some particular field(s). All committee actions may be appealed by written application to the Graduate Dean.

Failure to pass the preliminary oral examination terminates the student's work at this institution unless the examining committee recommends a reexamination. No reexamination may be given until at least one full semester has elapsed, and only one reexamination is permitted.

CANDIDACY

A doctoral student is admitted to candidacy upon passing the preliminary examinations without conditions or after fulfilling any conditions specified by the advisory committee.

FINAL ORAL EXAMINATION

The final oral examination is scheduled after the dissertation is complete except for such revisions as may be necessary as a result of the examination, but not earlier than one semester or its equivalent after admission to candidacy and not before all required course work has been completed or is currently in progress. The examination consists of the candidate's defense of the methodology used and the conclusions reached in the research, as reported in the dissertation. It is conducted by an examining committee, which consists of the student's advisory committee and a Graduate School representative. This examination is open to the University community.

A unanimous vote of approval of the advisory committee is required for passing the final oral examination. Approval may be conditioned, however, on the student's meeting specific requirements prescribed by the student's advisory committee. Failure of a student to pass the examination terminates one's work at this institution unless the advisory committee recommends a reexamination. No reexamination may be given until one full semester has elapsed and only one reexamination is permitted.

THE DISSERTATION

The doctoral dissertation presents the results of the student's original investigation in the field of major interest. It must represent a contribution to knowledge, be adequately supported by data and be written in a manner consistent with the highest standards of scholarship. Publication is expected.

The dissertation will be reviewed by all members of the advisory committee and must receive their approval prior to submission to the Graduate School. Two copies of the document signed by all members of the student's advisory committee must be submitted to the Graduate School by a specific deadline in the semester or summer session in which the degree is to be conferred. Prior to final approval, the dissertation will be reviewed by the Graduate School to insure that the format conforms to the specifications prescribed in the *Guide for the Preparation of Theses*. Detailed information on form and organization of the dissertation is presented in the University's *Guide for the Preparation of Theses* which is available in the Graduate School office.

The University has a requirement that all doctoral dissertations be microfilmed by University Microfilms International, of Ann Arbor, Michigan, which includes publication of the abstract in *Dissertation Abstracts International*. The student is required to pay for the microfilming service. (See "Special Registration and Fees" under "Tuition and Fees.")

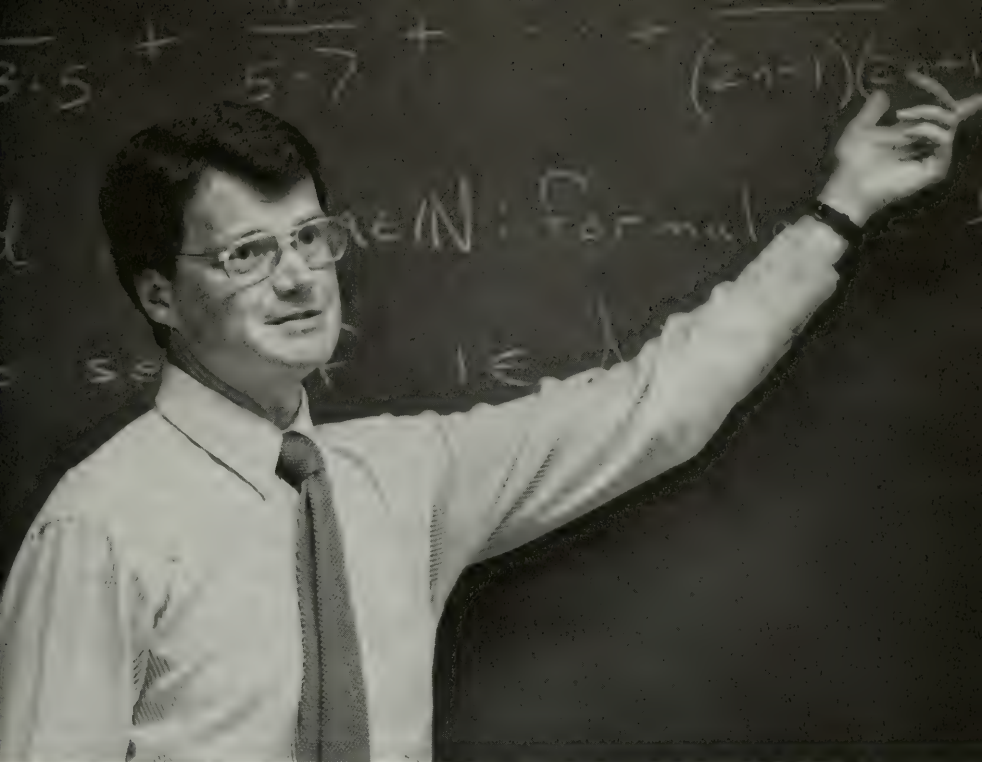
TIME LIMIT

Doctoral students are allowed a maximum of six calendar years from admission to the doctoral program to attain candidacy for the degree and a maximum of ten calendar years to complete all degree requirements. Academic schools or departments may have more restrictive requirements than the above stated University policy. All students admitted to doctoral programs effective Fall 1979 are subject to the above policy. Time limits for students admitted to doctoral programs prior to Fall 1979 but who were not admitted to candidacy as of Fall 1979 and who do not meet the above policy will be considered on an individual basis. Doctoral students admitted to candidacy prior to the 1979 fall semester are subject to the previous policy which allowed seven calendar years from admission to candidacy to completion of all degree requirements.

Summary of Procedures for the Doctor of Philosophy and Doctor of Education Degrees

1. Letter of inquiry from prospective student to Graduate School or department head.
2. Mailing of proper forms to student.
3. Receipt of application materials and required fee.
4. Review of application materials by department or program.
5. Department forwards recommendation regarding applicant's admissibility to Graduate Dean
6. The department's recommendation is reviewed and the student is notified of the action taken on the request for admission.
7. Student arrives, reports to the department, is assigned an adviser and makes out a roster of courses in consultation with the departmental adviser.
8. Advisory committee of at least four graduate faculty members, one of whom is designated as the chair and one of whom represents the minor field, appointed by the Graduate Dean upon the recommendation of the department head.
9. A dissertation subject is selected and an outline of the proposed research submitted to the student's advisory committee and the department head for review and approval.
10. Plan of Work prepared by the advisory committee with the student and submitted in quadruplicate to the department head and the Graduate School for approval as soon as feasible after completion of 12 hours of course work.
11. Three copies of the approved Plan of Work returned to the department. One copy is kept in department files, one is returned to the committee chair and one is given to the student.
12. Student passes language examination(s). (See page 62.)
13. Written examinations in the major and minor fields are scheduled no earlier than the end of the second year of graduate study and not later than one semester before the final oral examination. The results of these examinations will be reported to the Graduate School.

14. When all written examinations have been completed satisfactorily, the chairman requests the scheduling of the preliminary oral examination at least two weeks prior to the suggested date. Upon approval of the request, a graduate faculty member is selected to represent the Graduate School at the examination, and the student and examining committee are notified of the time and place. The report of the examination is sent to the Graduate School and if the examination has been passed without conditions, the student is admitted to candidacy.
15. A copy of the preliminary draft of the dissertation is submitted to the chair of the student's advisory committee for review.
16. The diploma order request form must be filed with the Graduate School by the end of the third week of the semester or summer session of anticipated graduation. Failure to submit the form by this date may result in the student's not receiving the diploma at graduation.
17. At least two weeks prior to the final oral examination, the chair of the student's advisory committee submits the dissertation to advisory committee members for review.
18. One semester or its equivalent after admission to candidacy or later, permission for the candidate to take the final oral examination is requested of the Graduate School by the chair of the candidate's advisory committee. Requests should be filed at least two weeks before the date of the examination and must be accompanied by a certification that the dissertation is complete except for such revisions as may be necessary as a result of the final examination. Upon approval of the request, the student and the examining committee, including a Graduate School representative, are notified of the time and place of the examination. The Graduate School Representative receives a copy of the dissertation at least one week prior to the examination.
19. Two copies of the dissertation signed by each member of the student's advisory committee and five copies of the abstract must be submitted to the Graduate School by a specific deadline in the semester or summer session in which the degree is to be conferred. Specific deadline dates appear in The Calendar. Two copies of the University Microfilms Agreement and two copies of the Survey of Earned Doctorate forms must be submitted with the dissertation.
20. The dissertation is reviewed by the Graduate School to insure that the format conforms with the specifications prescribed in the *Guide for the Preparation of Theses*.
21. All course work scheduled in a graduate degree classification must be completed prior to graduation.
22. A grade point average of at least 3.0 is required for graduation.
23. The statute of limitations for completion of degree requirements is described on page 65.



FIELDS OF INSTRUCTION

The course descriptions are planned for the academic years 1984-1985 and 1985-1986, unless indicated otherwise. Some listed courses may not be taught, however, if registration for a course is insufficient, or if faculty or facilities are not available.

Consent of the department is required for all practicum and individual special topics or special problems courses as well as internships and thesis or dissertation research.

In a typical course description, the semester hours of credit, the number of actual lecture and laboratory hours of meeting per week and the term or terms in which the course is offered are shown in this manner: 2(1-2) F,S,Sum. or 1-3 F,S,Sum.

In the first example, the "2" indicates the number of semester hours credit given for satisfactory completion of the course. The "(1-2)" indicates that the course meets for one hour of lecture and two hours of laboratory work each week. In the second example, the "1-3" indicates that a maximum of three and a minimum of one semester hours' credit can be earned. This is to be arranged with the instructor. The "F" designates that the course is to be given in the fall semester. Likewise, the "S" designates spring and the "Sum.," summer.

Abbreviations used in the course listings are: CI, consent of instructor; PBS, Post-Baccalaureate Studies status; grad. standing, admitted to the Graduate School; undergrad., undergraduate; sr., senior; jr., junior; preq., prerequisite; coreq., corequisite; lab., laboratory; lect., lecture; and alt. years, alternate years.

Courses at the 600-level are not ordinarily open to undergraduates, although occasional exceptions are made for senior honor students.

For 400-level course descriptions, see the Undergraduate Catalog.

Adult and Community College Education

GRADUATE FACULTY

Professor E. J. Boone, Head

Professor R. W. Shearon, Associate Head and Graduate Administrator

Professors: G. L. Carter Jr., J. C. Glass Jr., R. D. Mustian; Extension Professor: D. R. Proctor; Professors Emeriti: M. P. Burt, W. L. Carpenter, J. D. George, M. S. Knowles; Associate Professors: G. J. Andrews, A. Fingeret, R. T. Liles, J. W. Wright; Visiting Associate Professor: G. J. Andrews; Associate Professors Emeriti: W. L. Gragg, E. E. White; Assistant Professors: D. F. Campbell, R. Colquitt

The department is a component of both the School of Education and the School of Agriculture and Life Sciences. It offers programs of study leading to the Master of Education, Master of Science and Doctor of Education degrees with a major in adult and community college education. The program is directed toward administrators, supervisors and teachers in cooperative extension and community colleges and other adult education agencies.

The department's curriculum is interdisciplinary. It is specifically designed to help students acquire an integrated conceptual and theoretical framework derived from the behavioral and social sciences and education that will equip them to plan, administer and effect viable and relevant programs of change with individual learners, groups and larger societal aggregates in both formal and informal settings.

Further, the curriculum provides opportunities for students to acquire a high level of competence in identifying and diagnosing problematic situations and in proposing alternative courses of action and strategy in seeking solutions to problems. Cognate fields of study include anthropology, economics, politics, psychology and sociology.

The department is housed in Ricks Hall and Poe Hall. Graduate students on assistantships and internships are provided office space and equipment. Other graduate students are provided study space when possible.

For descriptions of the adult and community college education courses listed below, see education.

SELECTED ADVANCED UNDERGRADUATE COURSE

ED 478 Extension as Non-formal Education. *Preq.: Advanced undergrad. or PBS. 3(3-0)*
S.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

- ED 500** Community College and Two-year Postsecondary Education. 3(3-0) F,S.
- ED 503** The Programming Process in Adult and Community College Education. 3(3-0) F,S.
- ED 510** Adult Education: History, Philosophy, Contemporary Nature. 3(3-0) F,S.
- ED 537** The Extension and Public Service Function in Higher Education. 3(3-0) F,Sum.
- ED 538** Instructional Strategies in Adult and Community College Education. 3(3-0) F.
- ED 539** Educational Gerontology. 3(3-0) S.
- ED 543** Adulthood and Learning: The Later Years. 3(3-0) Alt. S.
- ED 559** The Adult Learner. 3(3-0) S,Sum.
- ED 567** Concepts and Strategies of Understanding, Motivating and Teaching Disadvantaged Adults. 3(3-0) S,Sum.
- ED 579** Concepts and Principles of Evaluation Applied to Non-formal Adult Education. 3(3-0) S.
- ED 585** Community Education. 3(3-0) S.
- ED 596** Topical Problems in Adult and Community College Education. *Credits Arranged.* F,S,Sum.

FOR GRADUATES ONLY

- ED 600** Organizational Concepts and Theories Applied to Adult and Community College Education. 3(3-0) F,Sum.
- ED 601** Administrative Concepts and Theories Applied to Adult and Community College Education. 3(3-0) S,Sum.
- ED (PS) 607** The Politics of Higher Education. 3(3-0) S.
- ED 696** Seminar in Adult and Community College Education. 1-3. F,S.

Agricultural Communications

- AC 590** Special Topics in Agricultural Communications. *Preq.: Sr. or grad. standing. 1-6.* Special Topics may be selected for study in the theoretical approaches to communications problems or experimental investigation with instructor guidance. Graduate Staff

Agricultural Education

For a listing of graduate faculty and departmental information, see education.

Air Conservation

The air conservation faculty includes some 50 faculty members representing 20 departments in four schools. It is the intent of this faculty and the associated program to provide training for students in the many disciplines related to air conservation. Such areas as air sampling, biological effects, air-quality management, sources, meteorology, law and economics and business are all important aspects covered by course offerings and research projects.

A graduate student desiring to minor in air conservation will have on his or her committee a member of the air conservation faculty from outside the individual's major department, representing this minor field. While there are no restrictions on the major, students minoring in air conservation should have a strong background in the life sciences, the physical sciences or engineering. The minor program will normally consist of 9 or more credits for the master's degree, 15 or more for the doctorate.

A variety of courses bearing on different aspects of the air conservation problem may be taken on this campus, at UNC-Chapel Hill or at Duke. The listing below shows relevant courses available at North Carolina State University. For courses at Duke and Chapel Hill see the appropriate catalogs.

Air Pollutants and Their Sources

CE 576 Atmospheric Pollution.

Meteorology and Pollutant Transport

MEA 555 Meteorology of the Biosphere.

MEA 556 Air Pollution Meteorology.

MEA 627 Atmospheric Turbulence and Diffusion.

Air Sampling and Analysis

ST 511 Experimental Statistics for Biological Sciences I.

ST 515 Experimental Statistics for Engineers.

CH 517 Physical Methods of Elemental Trace Analysis.

Effects on Human, Animal and Plant Receptors

FOR 353 Air Photo Interpretation and Photogrammetry.

ZO 400 Biological Issues in Human Ecology.

TOX 515 Environmental Toxicology.

BO 561 Physiological Ecology.

Air Quality Management

MAE 409 Particulate Control in Industrial Atmospheric Pollution.

WPS 525 Pollution Abatement in Forest Products Industries.

CHE 535 Engineering Economy in Air Pollution Control Systems.

MAE 570 Theory of Particulate Collection in Air Pollution Control.

Air Quality Law and Institutions

UNI 495 Special Topics in University Studies (Environment and Law).
PA 511 Public Administration.

Air Conservation Economics

EB 401 Economic Analysis for Non-Majors.
OR 501 Introduction to Operations Research.
EB 515 Environmental and Resource Policy.

Communications concerning the air conservation program, including inquiries from students wishing to minor in air conservation, should be directed to the Chairman, Air Conservation Faculty, Department of Chemical Engineering, P.O. Box 7905, North Carolina State University, Raleigh, North Carolina 27695-7905.

Animal Science**GRADUATE FACULTY**

Professor C. A. Lassiter, Head

Professor B. H. Johnson, Graduate Administrator

Professors: R. F. Behlow, J. H. Britt, K. R. Butcher, E. V. Caruolo, A. J. Clawson, D. G. Davenport, E. J. Eisen, L. Goode, R. W. Harvey, W. L. Johnson, E. E. Jones, J. R. Jones, J. M. Leatherwood, J. G. Lecce, J. E. Legates, B. T. McDaniel, R. D. Mochrie, R. M. Myers, B. R. Poulton, A. H. Rakes, H. A. Ramsey, O. W. Robison, F. D. Sargent, J. C. Wilk; *Professors Emeriti:* E. R. Barrick, G. Hyatt Jr., I. D. Porterfield, F. H. Smith, L. C. Ulberg, G. H. Wise; *Associate Professors:* R. G. Crickenberger, W. J. Croom, K. L. Esbenshade, J. J. McNeill, R. M. Petters, J. W. Spears, L. W. Whitlow; *Associate Professor Emeritus:* E. U. Dillard; *Assistant Professors:* M. T. Coffey, R. L. McCraw, K. R. Pond, M. W. Tess; *Visiting Assistant Professor:* J. E. J. van Eys

ASSOCIATE MEMBERS OF THE DEPARTMENT

Professor (USDA): J. C. Burns; *Assistant Professor:* M. D. Whitacre

The Department of Animal Science offers programs of graduate study leading to the Master of Agriculture, Master of Science and Doctor of Philosophy degrees. Animal science offers an opportunity for training in a diversity of basic sciences and the integration of such knowledge into the framework of a living system. Students may major not only in animal science but also in any one of the following disciplines: biochemistry, genetics, microbiology, nutrition and physiology. Animal science majors may specialize in one or more of these basic disciplines or in the more applied areas of management and production. The animal science major provides for the student who prefers a multidisciplinary approach. Majors in a

basic discipline are not only educated in it but have the added capability of integrating such knowledge into a living system, *i.e.*, the domestic animal. Minors can be obtained in any of the disciplines listed or in a variety of other areas.

Modern laboratories, specialized equipment and many different species of animals are available as research tools. A program of course work and a research project are developed for each student in accord with one's educational objectives. The primary goal is to provide the student with a challenging opportunity to develop his or her creative ability so that it may contribute significantly to a chosen discipline.

SELECTED ADVANCED UNDERGRADUATE COURSES

ANS 401 Reproductive Physiology. *Preq.: ZO 421. 3(2-3) F.*

ANS 402 Beef Cattle Management. *Preq.: ANS 204. 3(2-3) S.*

ANS 403 Swine Management. *Preq.: ANS 204. 3(2-3) F.*

ANS 404 Dairy Cattle Management. *Preq.: ANS 204. 3(2-3) S.*

ANS 405 Lactation. *Preq.: BS 100. 3(2-3) S.*

ANS 406 Sheep Management. *Preq.: ANS 204. 3(2-3) S. Alt. yrs.*

ANS 410 Horse Science. *Preq.: ANS 310 or CI. 3(2-2) S.*

ANS 411 Breeding and Improvement of Domestic Animals. *Preq.: GN 411. 3(3-0) F.*

ANS (PO, NTR) 415 Comparative Nutrition. *Preq.: CH 220 or both 221 and 223. 3(3-0) F.*

ANS (NTR) 419 Human Nutrition in Health and Disease. *Preqs.: ANS (NTR, PO) 415 or FS 400, BCH 451. 3(3-0) S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ANS 500 Advanced Ruminant Nutrition. *Preq.: ANS 204 or ANS 415. 3(3-0) Sum. Alt. yrs.* Advanced concepts in ruminant nutrition for the practicing agricultural professional. Protein, energy, vitamin and mineral nutrition in relationship to the nutritional needs and practical feeding of beef cattle, dairy cattle, sheep and goats. New developments in feeding systems, feed additives and the prevention and treatment of metabolic disorders.

Crickenberger, Croom, Whitlow

ANS (PHY) 502 Reproductive Physiology of Vertebrates. *Preq.: ZO 421. 3(3-0) S.* Emphasis will be placed on discussions of mechanisms which control the reproductive processes. Mechanisms which are species-limited will be compared with those which are shared by all species. Current knowledge of some subsystems will be investigated in detail while others will be referred to in reviews of well-documented research findings.

Britt, B. H. Johnson, Petters

ANS (GN) 508 Genetics of Animal Improvement. *Preqs.: GN 411, ST 511. 3(3-0) S.* Emphasis is placed on the utilization of basic principles of population and quantitative genetics in animal improvement. Factors affecting genic and genotypic frequencies and methods of estimating genetic and nongenetic variance, heritabilities and breeding values

are presented. The roles of mating systems and selection procedures in producing superior genetic populations are examined. Robison

ANS 510 Advanced Livestock Management. *Preq.: ANS 402 or ANS 403 or ANS 404. 3(3-0) S.* An advanced study of beef cattle, dairy cattle and swine management practices with particular emphasis on input-output relationships and the consequences of alternative management decisions. Problem. (Offered on-campus in even-numbered years.) Davenport

ANS (NTR) 516 Quantitative Nutrition. *3(1-6) S.* (See nutrition.)

ANS 520 Tropical Livestock Production. *Preq.: Six hours of ANS at 400-level. 3(3-0) F.* Modern principles of feeding, genetics, forage production and management are applied to improvement of meat and dairy animals in tropical, subtropical and high-altitude environments. Considers biological and socio-economic constraints to development of livestock industry. Discussion of climatic effects on production applies to U. S. conditions and to developing tropical countries. W. L. Johnson

ANS (NTR) 540 Ruminant Physiology and Metabolism. *Preqs.: BCH 451 or 551, ZO 421. 3(3-0) F. Alt. yrs.* Detailed discussion of the ruminant digestive system, its dependent microbial fermentation and the unique aspects of ruminant tissue metabolism. Emphasis is given to the understanding of the interdependent relationship between the rumen microbial fermentation and the host animal's physiology and metabolism. The effects of changes in diet and physiological state and their relationship to various digestive and metabolic dysfunctions are discussed. (Offered 1986 and alt. years.) Croom, McNeill

ANS (PHY) 580 Mammalian Endocrine Physiology. *Preqs.: BCH 451, ZO 421. 3(3-0) F. Alt yrs.* Detailed discussion of the mammalian endocrine system with emphasis on the functional aspect, chemistry and mode of action of specific hormones secreted from major endocrine glands. Modern biochemical and physiological principles of hormonal integrations and neuroendocrine integration are examined. (Offered 1986 and alt. yrs.) B. H. Johnson

ANS 590 Topical Problems in Animal Science. *Maximum 6 F.S.* Special problems may be selected or assigned in various phases of animal science. Graduate Staff

FOR GRADUATES ONLY

ANS (GN) 603 Population Genetics in Animal Improvement. *Preqs.: ST 512, GN 506. 3(3-0) F.* A study of the forces influencing gene frequencies, inbreeding and its effects, and alternative breeding plans. Eisen

ANS (PHY) 604 Experimental Animal Physiology. *Preq.: ZO (PHY) 513 or equivalent. 4(2-4) S.* A study of the theories and techniques involved in the use of animals in physiologic investigation with special emphasis on the diversity of physiological applications on this campus. Caruolo

ANS (NTR, PO) 605 Mineral Metabolism. *Preqs.: ANS (NTR, PO) 415 or BCH 551, BCH 451 and ZO 421. 3(3-0) F.* Requirements, function, distribution, absorption, excretion and toxicity of minerals in humans and domestic animals. Interactions between minerals and other factors affecting mineral metabolism or availability. Emphasis on mechanisms associated with mineral functions and the metabolic bases for the development of signs of deficiency. Spears

ANS 690 Seminar in Animal Nutrition. *Preq.: Consent of seminar leaders. 1(1-0) F.S.* Orientation in philosophy of research, preparation for research and general research methodology. Graduate Staff

ANS 699 Research in Animal Science. *Credits Arranged. F.S.* A maximum of six hours is allowed toward the master's degree; no limitation on credits in doctorate program.

Graduate Staff

For related courses, see:

BCH 551 General Biochemistry I. *3(3-0) F.*

MB 551 Immunology I. *3(3-0) F.*

NTR 601 Protein and Amino Acid Metabolism. *3(3-0) S.*

NTR 608 Energy Metabolism. *3(3-0) F.*

Anthropology

For anthropology courses, see sociology and anthropology.

Architecture

GRADUATE FACULTY

Professor R. P. Burns Jr., Program Director

Professors: P. Batchelor, R. H. Clark, C. E. McKinney, M. Pause, G. J. P. Reuer, H. Sanoff, V. F. Shogren, E. W. Taylor; *Professors Emeriti:* G. L. Bireline Jr., J. H. Cox, H. H. Harris, H. L. Kamphoefner, D. R. Stuart; *Associate Professors:* F. Harmon, J. P. Rand, P. Tesar; *Associate Professor Emeritus:* D. W. Barnes Jr.; *Assistant Professors:* L. W. Sanders, J. O. Tector, E. F. Weinell

The Master of Architecture program at NCSU's School of Design prepares students to assume responsible professional roles in architecture.

The primary goal of the program is to help students achieve a high level of competence in architectural design, by building knowledge and skills necessary for professional activity; developing a commitment to professional values and responsibilities; understanding the variety of roles for architects in practice and related fields; and developing as unique, autonomous individuals, who accept responsibility for their professional, intellectual and creative development.

In the Master of Architecture program, students encounter architectural problems at a variety of scales, requiring analytic, conceptual and developmental abilities. The design studio is the focus of this activity, enabling students to test ideas and theories about design in the context of both 'real life' and idealized problems. The final semester in studio is devoted to a self-initiated, detailed architectural project that is carried out under the guidance of the student's graduate advisory committee.

Other course work supplements and amplifies these experiences. Diverse courses are available within the School of Design in urban and community design, architectural history and theory, methods and programming, architectural conservation, management and professional practice and building technology. The program's flexible curriculum offers the student considerable freedom to individualize his or her plan of study, based on personal educational and professional goals.

The Master of Architecture is a first professional degree accredited by the National Architectural Accrediting Board. As such, it satisfies educational requirements for professional certification established by the various states and the National Council of Architectural Registration Boards. The department also offers a parallel 4 + 1 Bachelor of Architecture program which provides similar qualification for professional certification.

The majority of recent graduates have chosen to enter private architectural practice, undertaking the rich professional challenges it offers. While acknowledging the primacy of the practice orientation, the Master of Architecture program enlarges the professional framework to include alternative, nontraditional career roles as well. A distinctive characteristic of the program is its context within the School of Design, which offers the additional perspectives of landscape architecture, product design and visual design. Complementary course work may also be taken throughout North Carolina State University and at nearby University of North Carolina at Chapel Hill and Duke University.

Students are encouraged to exercise initiative and responsibility in realizing their personal educational goals. At this school, student independence is seen as instrumental in helping to shape not only decision-making capabilities but future leadership potential as well.

The Department of Architecture offers three tracks to the Master of Architecture degree. Track 1 is for applicants with a four-year undergraduate degree in architecture and may be completed in two years of full-time study. Track 2 is for applicants holding a five-year NAAB-accredited Bachelor of Architecture degree and normally requires two semester plus one summer, or three semesters, in residence. Track 3 is for students with degrees in fields other than architecture. This normally requires four semesters of preparatory work before entering the final two-year program of graduate study. Some applicants with design-related academic or professional experience may be able to complete the preparatory work in less than four semesters; each case is evaluated individually.

SELECTED ADVANCED UNDERGRADUATE COURSE

ARC 400 Intermediate Architectural Design (Series). *Preq.: DF 102. May not be taken more than six times. 6(0-9) F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ARC 501 Professional Architecture Studio I. *Preqs.: BEDA degree or equivalent and CI; Coreq.: ARC 510. 6(0-12) F,S.* Design studio investigations aimed at the development of an understanding of the major issues confronting the contemporary architect and at the expanding of problem solving abilities in architectural design.

ARC 502 Professional Architecture Studio II. *Preqs.: ARC 501; ARC 510 and CI. 6(0-12) F,S.* Design investigations aimed at the development of an understanding of the major issues confronting the contemporary architect and at the expanding of problem solving abilities in architectural design. This is an individualized, final project studio.

ARC 510 Architectural Design Project Preparation. *Preqs.: BEDA degree or equivalent and CI. 3(3-0) F,S.* A seminar course designed to assist students to prepare the groundwork for the final project to be carried out in the design studio.

ARC 521, 522 Advanced Architectural Structures I, II. *Preq.: (521) DN 352; (522) ARC 521. 3(3-0) F,S.* Gravity and non-gravity loads on structures; comparative behavior of structural materials; comparative behavior of simple structural systems; approximate and exact analysis procedures as applied to systems; principles of approximate and exact design in timber, steel and reinforced concrete; architectural/structural/mechanical compatibility in systems; basic principles of foundation analyses and design.

ARC 531, 532 Advanced Building Technology I, II. *Preqs.: DN 253, 254. 2(1-3) F,S.* A synthesis of studies in building science undertaken in previous courses. Material assemblies in practical applications, dimensional characteristics of mechanical and construction systems for buildings, and special projects in selected areas of building science.

ARC 542 Investigations in Recent World Architecture. *Preq.: CI. 3(2-1) F.* A lecture-seminar course intended to provide a description and analysis of recent developments in architectural design through an examination of projects by many of the world's most important architects. Primary emphasis will be placed on emerging design concepts and theories as expressed in the built architecture and the visionary proposals of the past two decades.

ARC 543 Analysis of Precedent. *Preq.: Grad. standing or CI. 3(0-3) S.* The investigation of architectural elements, relationships, and ordering ideas through a comparative graphic examination and analysis of the work of architects. Emphasis on buildings as physical artifacts.

ARC 544 Architectural Conservation. *Preq.: Advanced undergrad. in SOD or grad. standing. 3(3-0) S. Alt. yrs.* An examination of the many dimensions of architectural conservation and/or preservation as a significant aspect of architectural practice. Historical evolution, regulatory and economic factors, technology and pertinent design issues will be explored as foundations for individual case studies by class members of selected adaptive use, rehabilitation and restoration projects.

ARC 546 Theory of Building Types. *Preq.: Two ARC studios. 3(3-0) F.* Typology in its theoretical implications and practical applications in architecture. Analysis and documentation of selected building types in their historical evolution. Graphic identification of type characteristics.

ARC 551 Design Methods and Programming. *Preq.: Grad. standing. 3(3-0) F.* The focus of this course is the exploration of concepts and techniques suitable for use in design problem-solving situations. One component of the course is devoted to a rationale for systematic inquiry and its link to creative problem solving. The second component will examine various process models leading to the design program which has been described as first generation methodology. The final component of the course will examine program methods which extend design thinking toward over-participation techniques.

ARC 561 The Practice of Architecture. *3(3-0) F.* A lecture course which examines the practice of architecture, with emphasis given to both normative and emerging procedures in the private architectural firm. The role and function of the practicing architect, legal and regulatory conditions, the nature of professional services, office management and project management processes will be given special attention.

ARC 562 Project Processes in Architecture. *Preq.: Sr. or grad. standing. 3(3-0) S.* A course which examines the processes of project delivery in architectural practice from initiation to completion of projects. Lectures and case studies of current projects will provide the means to explore the nature of architectural services involved, the roles of participants and the creative and technical issues which must be resolved.

ARC 570 Theory of Urban Form. *Preq.: Advanced undergrad. 3(3-0) F. Alt. yrs.* Survey of interdisciplinary theory of urban growth and evolution with about one half of the class

period devoted to historical development of theory, and the other half devoted to contemporary quantitative models of urban form.

ARC 571 Urban Housing. *Preq.: Advanced undergrad. 3(3-0) S.* A lecture-seminar course intended to reveal the interrelationships between the form of housing and the processes of urban evolution, and to explore housing design as a function of economic, public policy, social and technological influences. Emphasis is placed on the physical form of housing through developments in the latter half of the twentieth century.

ARC 572 Urban Programming. *Preq.: Grad. standing or CI. 3(3-0) F. Alt. yrs.* This course is designed to reveal the programmatic requirements of communities in terms of density, size, physical structure and evolutionary characteristics. It is based on the analysis of social and economic characteristics of urban populations, and provides the designer and planner with estimates of the projected demand for facilities and services.

ARC 573 Environmental Perception. *Preq.: Grad. standing or CI. 3(3-0) S.* The course is designed to acquaint the student with the theories and research on the perception of urban environments. Emphasis is placed on the visual attributes as well as user perceptions of the environment with a focus on the structuring of research to explore these dimensions.

ARC 574 Place and Place Making. *Preq.: Grad. standing or CI. 3(3-0) F.* A seminar-lecture course which examines the definitions, concepts and emergent research findings that are useful in explaining the human sense of place. Particular emphasis is placed upon those physical aspects and relationships which influence this sense of place and over which the designer has some control.

ARC 581, 582 Conceptual Issues in Architecture and Design. *Preq.: Grad. standing or advanced undergrad. 3(3-0) F,S.* Fall semester—An examination and dialogue concerning current issues in American and Western society and their relation to the activities and goals of architects and designers. Spring semester—An investigation into issues and values currently held by participating students and their relation to an anticipated career in architecture and design.

ARC 591 Special Seminar. *Preq.: Grad. standing. 1-3 F,S.* Seminars on subjects of current interest in design which are presented by persons not part of the regular faculty.

ARC 592 Special Topics. *Preq.: Grad. standing. 2-3 F,S.* Topics of current interest to the programs in the School of Design offered by faculty in the School. Subjects offered under this number are normally used to test and develop new courses.

ARC 595 Independent Study. *Preq.: Grad. standing. 1-3 Max. 6. F,S,Sum.* Special problems in various aspects of design developed under the direction of a faculty member on a tutorial basis.

FOR GRADUATES ONLY

ARC 600 Advanced Architectural Design (Series). *Preq.: 24 hours ARC 400 or equivalent. 6(0-12) F,S.* Advanced studies in architectural design in which are investigated large-scale architectural problems having complex functional, social and economic implications leading to a synthesizing of all previous design experience through in-depth investigations of significant architectural environmental problems. Early emphasis is given to problem identification, program formulation and design application; consultation with planners and environmental specialists is extensive. A final project is developed in the last semester.

ARC 691, 692 Special Topics in Architecture. *Preq.: Grad. standing. 1-6 F/S.* An investigation of special topics in architecture of particular interest to advanced students under the direction of a faculty member on a tutorial basis. Credits and content will vary with the needs of students.

Biochemistry

GRADUATE FACULTY

Professor S. B. Tove, Head

Associate Professor: J. A. Knopp, Graduate Administrator

Professors: F. B. Armstrong, H. R. Horton, J. S. Kahn, I. S. Longmuir, A. R. Main, W. L. Miller, E. C. Sisler, E. C. Theil; Assistant Professor: E. S. Maxwell

ASSOCIATE MEMBERS OF THE DEPARTMENT

Professors: L. W. Aurand, E. E. Jones, H. E. Swaisgood; Assistant Professor: L. M. Ballas

The field of biochemistry applies and extends the concepts of chemistry and physics to the investigation of biological problems. The Department of Biochemistry offers courses of study leading to the Master of Science and Doctor of Philosophy degrees.

A student entering graduate study in biochemistry should have a bachelor's degree in biochemistry, chemistry or a related physical or biological science. In any case, the undergraduate program of study should have included a minimum of two semesters of organic chemistry, two semesters of physical chemistry, one semester of introductory biochemistry and one semester of qualitative organic analysis. New students entering degree programs take placement examinations in organic and physical chemistry to determine their level of competence in these areas. Students who lack undergraduate courses considered essential for graduate study in biochemistry may be admitted to the graduate program, provided the deficiencies are corrected early in their graduate work.

Courses in general and experimental biochemistry are required as part of programs leading to advanced degrees in biochemistry. Other courses in biochemistry and related areas are required as recommended by the student's advisory committee. In addition, the student is expected to participate regularly in seminars and obtain teaching experience. Completion of a thesis based on original research is required for both the Master of Science and Doctor of Philosophy degrees, and a reading knowledge of one foreign language is required for the doctoral degree. Research programs are currently being conducted in biochemical genetics, enzyme structures and mechanisms, biochemical aspects of toxicology, regulation of metabolism, fluorescence spectroscopy of proteins and nucleic acids, enzyme kinetics, phytosynthesis and electron transport, molecular interactions of

ethylene in plants and developmental biochemistry of plants, lipid and membrane metabolism, nucleic acid metabolism, oxygen transport mechanisms, developmental changes in red blood cells and iron metabolism, bio-oxidation of lipids and foods, immobilization of enzymes and biomolecules, mechanisms of hormone action and disulfide bond formation in proteins and peptides.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

BCH 551 General Biochemistry I. *Preq.: Three years of chemistry, including CH 223 or equivalent and one semester of introductory biochemistry (BCH 451 or equivalent); one semester of physical chemistry would be helpful. 3(3-0) F.* Protein structure and function, carbohydrate metabolism and the production of chemical energy, lipids and membrane structure and function, nucleic acids and protein metabolism. Horton

BCH 552 Experimental Biochemistry. *Preqs.: CH 223; CH 315 recommended; Preq. or Coreq.: BCH 551. 3(1-6) F.* An advanced laboratory designed to give students practical experiences in purification and quantitative characterization of enzymes and nucleic acids. Studies with carbohydrates and membrane lipids will also be included. Miller

BCH (PHY) 553 Physiological Biochemistry. *Preq.: BCH 551. 3(3-0) S.* Application of biochemical methods to the elucidation of the function of whole organisms. A. Biochemistry of 1) blood, 2) water, electrolyte, acid-base balance, 3) renal function, 4) muscle metabolism, 5) central nervous system, 6) autonomic nervous system, 7) endocrine system. B. Biochemistry of adaptation to environment: 1) high and low P_{O_2} , 2) hot and cold, 3) wet and dry, 4) pollution. Longmuir

BCH 554 Radioisotope Techniques in Biology. *Preq.: BCH 451 or CI. 2(1-3) Sum.* Theory and application of radioisotope techniques used in biology. The different modes of radioactivity are correlated with methods of measurement. Emphasis on use and limitations of various instruments and techniques and on their application to research problems. Sisler

BCH 555 Plant Biochemistry. *Preq.: BCH 551 or equivalent. 3(3-0) S. Alt. yrs. ** The basic biochemistry of plants. Basic constituents of plants, their metabolic interrelationships and their regulation: cell wall structure, carbohydrates, proteins, nucleic acids, lipids, photosynthesis, respiration, secondary plant products, nitrogen metabolism, phytoalexins and plant hormones. Sisler

BCH 557 Introductory Enzyme Kinetics. *Preqs.: BCH 551 and MA 201 or 212. 3(3-0) F. Alt. yrs. ** Basic principles of chemical kinetics are applied to develop enzyme kinetics. Limitations of the Michaelis equation are considered in light of the general rate equation. Transient state kinetics are then considered. Inhibition and activation, pH functions, effects of temperature, and elucidation of mechanisms follow. The kinetics of allosteric site interactions and of conformational forms complete the course. Main

BCH (GN) 561 Biochemical and Microbial Genetics. *Preqs.: BCH 451 or 551, GN 411 or 505, MB 401 or equivalent. 3(3-0) S.* A study of the development of the fields of biochemical and microbial genetics, emphasizing both techniques and concepts currently used in molecular research. Includes lectures and discussions of current research publications. Armstrong

BCH 590 Special Topics in Biochemistry. *Preq.: BCH 451 or equivalent. Credits arranged, Max. 3 F.S.Sum.* The study of topics of special interest by small groups of students instructed by members of the faculty. Graduate Staff

*See department for specific year.

FOR GRADUATES ONLY

BCH 651 Physical Biochemistry. *Preq.: BCH 551. 3(3-0) F. Alt. yrs.* * Structural and physical properties of biological macromolecules and the application of spectroscopic methods to their study. Knopp

BCH 652 Biochemical Research Techniques. *Preq.: BCH 551 and CH 431 or CI. 3(1-6) F. Alt. yrs.* * Theory and interpretation of physical measurements of macromolecular structure with particular emphasis given to analysis of interactions of proteins. Laboratory experiments demonstrate transport and equilibrium properties of interacting proteins: multiple binding equilibria, difference spectroscopy, analytical gel chromatography, affinity chromatography, electrophoresis, velocity sedimentation and equilibrium ultracentrifugation. Swaisgood

BCH 653 Biochemistry of Hormone Action. *Preq.: BCH 551. 3(3-0) S. Alt. yrs.* * Well defined models of steroid and protein hormone action are studied via lectures, assigned readings and discussions. Students add breadth to the course and depth to their own understanding by searching the literature and writing or lecturing about a particular hormone of their own choosing. Miller

BCH 655 General Biochemistry II. *Preq.: BCH 551. 3(3-0) S.* A continuation of BCH 551 with emphasis on enzyme kinetics, allosterism and cooperativity, micelles and biological membranes, bioenergetics and metabolism of carbohydrates and lipids. Tove

BCH 657 General Biochemistry III. *Preq.: BCH 551. 3(3-0) F.* A continuation of BCH 551 with emphasis on enzyme mechanisms, relation of enzyme structure to catalytic mechanisms, and specificity, structure and function of nucleic acids, metabolism of nitrogenous biomolecules and modes of metabolic regulation. Maxwell

BCH (CH) 659 Natural Products. *3(3-0) F.* (See chemistry.)

BCH 691 Seminar in Biochemistry. *1(1-0) F,S.* Graduate Staff

BCH 695 Special Topics in Biochemistry. *Preq.: Grad. standing in BCH. Credits Arranged. F,S,Sum.* Critical study of special problems and selected topics of current interest in biochemistry and related fields. Graduate Staff

BCH 699 Biochemical Research. *Credits Arranged, F,S,Sum.* Graduate Staff

*See department for specific year.

Biological and Agricultural Engineering

GRADUATE FACULTY

Professor F. J. Hassler, Head

Professors: C. F. Abrams, H. D. Bowen, B. K. Huang, F. J. Humenik, E. G. Humphries, W. H. Johnson, G. J. Kriz, W. F. McClure, R. P. Rohrbach, R. W. Skaggs, R. E. Sneed, R. S. Sowell, C. W. Suggs, P. W. Westerman, E. H. Wiser, J. H. Young; *Professors (USDA):* J. W. Dickens, T. B. Whitaker; *Extension Professor:* J. C. Barker; *Professor Emeritus:* D. H. Howells; *Associate Professors:* G. R. Baughman, L. M. Safley Jr., D. H. Willits; *Assistant Professor:* C. G. Bowers Jr.; *Senior Researcher:* S. C. Mohapatra

ASSOCIATE MEMBERS OF THE DEPARTMENT

Professors: D. D. Hamann, A. E. Hassan, V. A. Jones; *Associate Professor:* K. R. Swartzel

The Department of Biological and Agricultural Engineering offers programs of study for the Master of Science, Doctor of Philosophy and Master of Biological and Agricultural Engineering degrees.

In the Master of Science program emphasis is placed on mathematics and theory as the unifying link between otherwise divergent fields of knowledge in the biological and physical sciences and as prerequisites to effective engineering advances in biological and agricultural areas. As the student acquires competence in the advanced methods of science, he or she applies knowledge by conducting an original research investigation and by writing and defending a thesis.

Study for the Doctor of Philosophy degree builds on the Master of Science program with additional formal study followed by a period of independent dissertation research.

Current departmental research projects available for graduate student participation include animal waste treatment and recycling systems, instrumentation to measure quality and composition of agricultural commodities, mechanization of field and horticultural crops (tobacco, sweet potatoes, cucumbers, blueberries, grapes, ornamental plants, floral crops, and greenhouse vegetables), peanut and tobacco processing, drainage and water table control systems, hydrologic models for agriculture, poultry production systems, occupational safety and health in agriculture and production systems for cotton, soybeans, tobacco, sweet potatoes, peanuts and floral crops.

For those interested primarily in a broadened background of engineering science and technology—without the thesis requirement—the Master of Biological and Agricultural Engineering program permits a wide selection from a variety of advanced courses. While this program is primarily for those intending to terminate graduate study at the master's level, a student may, with departmental approval, develop a plan of study under this program which leads to study for the doctorate.

Graduate students have access to modern well-equipped research laboratories, controlled environment test chambers, excellent computing facilities and a research shop manned by competent mechanics.

Information concerning fellowships and assistantships may be obtained from the department head.

SELECTED ADVANCED UNDERGRADUATE COURSES

BAE 411 Farm Power and Machinery. *Preqs.:* BAE 211, CH 101, PY 211 or 221. 3(2-3) S.

BAE 461 Analysis of Agricultural Systems. *Preqs.:* MA 114 or 112, EB 212. 3(2-2) F.

BAE 462 Functional Design of Field Machines. *Preq.:* BAE 361; *Coreq.:* ST 361. 3(2-3) S.

BAE (CHE) 465 Introduction to Biomedical Engineering. *Preqs.:* MA 202 or 212 or PY 212 or 208. 3(3-0) S.

BAE 471 Soil and Water Engineering. *Preqs.: BS 100, SSC 200, MAE 308. 4(3-2) F.*

BAE 481 Agricultural Structures and Environment. *Preqs.: BAE 342, MAE 314. 4(3-3) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

BAE 552 Instrumentation for Agricultural Research and Processing. *Preqs.: EE 331, MA 301. 2(1-3) F. Alt. yrs.* Theory and application of primary sensing elements and transducers. Generalized performance characteristics and the use of standards. Use of specialized measurement systems for agricultural research and processing including an introduction to correlation and power spectral density measurements. McClure

BAE (CE, MB) 570 Sanitary Microbiology. *3(2-3) S.* (See civil engineering.)

BAE (CE) 578 Agricultural Waste Management. *Preq.: Grad. or advanced undergrad. standing. 3(2-3) F. Alt. yrs.* A study of agricultural and associated processing wastes. Special laboratory techniques required for the characterization of these wastes will be emphasized. Principles and examples considered will be utilized to develop waste management and non-destructive waste utilization systems that are integral to the total operation. Barker

BAE (FS) 585 Food Rheology. *Preqs.: FS 331 or MAE 314. 3(2-3) F. Alt. yrs.* Principles and methods for measuring rheological properties. Theories of elastic, viscous, viscoelastic and viscoplastic behavior and relationships to food texture and commodity damage during harvest, handling and processing. Influence of time, composition and processing on rheological properties. Hamann

BAE 590 Special Problems. *Preq.: Sr. or grad. standing in biological and agricultural engineering. Credits Arranged.* Each student will select a subject on which to do research and write a technical report on the results. The individual may choose a subject pertaining to his or her particular interest in any area of study in biological and agricultural engineering. Graduate Staff

FOR GRADUATES ONLY

BAE 654 Nonequilibrium Thermodynamics in Bioengineering. *Preq.: MA 511. 3(3-0) S. Alt. yrs.* Generalized classical thermodynamics is extended by Onsager's relations to provide a theoretical basis for analyzing the energetics of systems that include life processes. Topics illustrate applications to special systems including isothermal diffusion and sedimentation, membrane permeability, transport processes in continuous systems and systems with temperature gradients. Graduate Staff

BAE 661 Analysis of Function and Design of Biological and Physical Systems. *Preq.: CI. 3(2-3) F. Alt. yrs.* Mathematical and analytical techniques and principles essential in the analysis and design of machines and systems which encompass both the biological and the physical domains and their interfaces. Analytical treatment of physical and biological systems and the functional analysis of machine components are studied to bridge the gap between theories and applications. Control systems synthesis and design are treated with emphasis on quantitative dynamic relations between elements and system response using transfer function and computer simulation techniques. Bowen, Huang

BAE (SSC) 671 Theory of Drainage—Saturated Flow. *Preq.: MA 301. 3(3-0) F. Alt. yrs.* Physical concepts and properties of fluids and porous media are discussed in relation to soil-water movement. The fundamental laws and equations governing saturated flow in porous media are derived and discussed. Mathematical solutions of steady-state and transient flow equations are analyzed to determine their applicability to drainage problems. Analogs and models of particular drainage problems are considered. Skaggs

BAE (SSC) 674 Theory of Drainage—Unsaturated Flow. *Preq.: BAE 671 or equivalent. 3(3-0) S. Alt. yrs.* Forces involved and theories utilized in unsaturated flow of porous media are discussed in relation to soil-water movement. Steady-state and transient unsaturated flow equations for horizontal and vertical moisture movement are developed and solved. The solutions are applied to present day laboratory and field technology. Molecular diffusion and hydrodynamic dispersion are considered in light of current tracing techniques. Skaggs

BAE 690 Special Topics. *Preq.: Grad. standing. 1-4.* A study of topics in the special fields of interest of graduate students under the direction of the graduate faculty.

Graduate Staff

BAE 695 Seminar. *Preq.: Grad. standing in BAE. 1(1-0) F,S.* Elaboration of the subject areas, techniques and methods peculiar to professional interest through presentations of personal and published works; opportunity for students to present and critically defend ideas, concepts and inferences. Discussions to point up analytical solutions and analogies between problems in biological and agricultural engineering and other technologies, and to present the relationship of biological and agricultural engineering to the socio-economic enterprise.

Sowell

BAE 699 Research in Biological and Agricultural Engineering. *Preq.: Grad. standing in BAE. Credits Arranged.* Performance of a particular investigation of concern to biological and agricultural engineering. The study will begin with the selection of a problem and culminate with the presentation of a thesis.

Graduate Staff

Biological Sciences

Professor C. F. Lytle, Teaching Coordinator

There is no separate graduate major in the biological sciences, but several interdisciplinary courses are coordinated by the Biological Sciences Interdepartmental Program of the School of Agriculture and Life Sciences. These courses are applicable to several major and minor programs. Current courses include:

SELECTED ADVANCED UNDERGRADUATE COURSE

BS 491 Seminar on Professional Development in Biological Sciences. *1(1-0) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

BS 590 Special Problems in Biological Instrumentation. *Preq.: CI. 1-3 F,S.* Basic components of spectrophotometers including light sources, dispersing devices, detectors and read-out methods; theoretical and practical aspects of electron microscopy; basics of analog and digital computing methods and applications of computers to biological research; methods of separation and identification of bio-polymers; principles of measurement; the application of electronics in biological measuring and sensing devices; and human cytological techniques. Course consists of five-week modules (sections) devoted to specific types of instrumentation.

Graduate Staff

FOR GRADUATES ONLY

BS 690 Seminar in Cell Biology. *Preqs.: Grad. standing, background in biology or chemistry. 1(1-0) S.* A topical appraisal of current literature in selected areas of cell biology through presentations and discussions by students, faculty and visiting scientists.

Graduate Staff

BS 696 Topics in Biological Ultrastructure. *Preq.: Grad. standing (background preferably in biology).* 1(1-0) F. A survey of the ultrastructure of living organisms from viruses to higher plants and animals by means of illustrated lectures. The changes in fine structure associated with differentiating cells and with cells in various metabolic states are examined. Graduate Staff

Biomathematics

GRADUATE FACULTY

Professor D. L. Solomon, Administrative Coordinator

Professor H. R. van der Vaart, Graduate Administrator

Professors: H. J. Gold, D. L. Ridgeway, B. S. Weir; Adjunct Professor: M. W. Anderson; Professor Emeritus: R. J. Monroe; Associate Professors: K. H. Pollock, M. Wann; Assistant Professor: C. E. Smith

ASSOCIATE MEMBERS OF THE PROGRAM COMMITTEE

Professors: J. W. Bishir, G. Namkoong, H. E. Schaffer, R. E. Stinner; Associate Professor: L. A. Real

Biomathematics is the development and application of mathematical methods for the study of biological systems. The focus is the modeling process, which is the matching of the biological and physical structure of the system being studied to the mathematical description. Students pursuing degrees in biomathematics can choose to emphasize (1) the *development* of mathematical modeling methodology as opposed to the *application* of that methodology, (2) the mathematical sciences, by taking advantage of the diverse offering in statistics, mathematics, computer science and operations research, or (3) the biological sciences, by fashioning a program which takes advantage of the courses offered by individual biological science departments or interdepartmental programs such as ecology, physiology, nutrition, wildlife biology and toxicology.

Furthermore, work in biomathematics varies from the study of general biological theory (e.g., population dynamics, feedback regulation in enzyme systems) to specific applications (e.g., pollution of a specific river system). Most research has both elements. Finally, the modeling of biological systems often requires the scholarly resources of several disciplines and thus is characterized by interdisciplinary collaboration. The modeling serves to integrate the contributions of the various areas and to provide a means by which the collaborators communicate.

Applicants to the program are expected to have either a B.S. in biology with evidence of aptitude and interest in mathematics or a B.S. in a mathematical area with evidence of aptitude and interest in biology. All students are expected to have had advanced calculus, linear algebra and general biology. Deficiencies in these areas should be remedied during the first year.

The Biomathematics graduate program is administered as a division within the Department of Statistics, with associate faculty drawn from several other depart-

ments. Further information may be found in the description for the Department of Statistics. A brochure is available which describes the biomathematics degree requirements and research interests of the faculty.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

BMA (BO) 567 Modeling of Biological Systems. *Preq.: MA 112. 4(3-2) F.* An introduction to modeling in biology, with examples from biochemical, physiological and ecosystem levels. Use of Forrester diagrams, probabilistic and deterministic description of dynamic processes, feedback relations, steady-state and homeostasis, symbolic computer languages and model validation. Examination of current literature dealing with application of models and simulation in biology. Individual and class modeling projects. Graduate Staff

BMA (MA, ST) 571 Biomathematics I. *Preq.: Advanced calculus, reasonable background in biology or CI. 3(3-0) F.* The role of theory construction and model building in the development of experimental science. The historical development of mathematical theories and models for the growth of one-species populations (logistic and off-shoots), including considerations of age distributions (matrix models, Leslie and Lopez; continuous theory, renewal equation). Some of the more elementary theories on the growth of organisms (von Bertalanffy; allometric theories; cultures grown in a chemostat). Mathematical theories of two and more species systems (predator-prey, competition, symbiosis; according to the Volterra-Lotka schemes, leading up to present-day research), and discussion of some similar models for chemical kinetics. Much emphasis is placed on scrutiny of the biological concepts as well as of the mathematical structure of the models in order to uncover both weak and strong points of the models discussed. Mathematical treatment of the differential equations in these models stresses qualitative and graphical aspects, as well as certain aspects of discretization. van der Vaart

BMA (MA, ST) 572 Biomathematics II. *Preqs.: BMA 571, elementary probability theory. 3(3-0) S.* Continuation of topics of BMA 571. Some more advanced mathematical techniques concerning nonlinear differential equations of the types encountered in BMA 571: several concepts of stability, asymptotic directions, Liapunov functions, different time-scales. Comparison of deterministic and stochastic models for several biological problems including birth and death processes. Discussion of various other applications of mathematics to biology, some recent research. van der Vaart

BMA 591 Special Topics. *Preq.: CI. Maximum 3. F,S,Sum.* Directed readings, problem sets, written and oral reports as dictated by need and interest of student; new 500-level courses during the developmental phase. Graduate Staff

FOR GRADUATES ONLY

BMA (OR) 611 System Modeling Theory. *Preqs.: MA 405; ME 421 or ST 421; linear systems (e.g., BMA 572 or IE 522 or OR 531). 3(3-0) F. Alt. yrs.* System concepts and modeling processes. Objectives include the following: develop understanding of the modeling process; develop and improve skills in system modeling; provide basis for accessing research literature. Topics include: graph theory and system structure; system morphisms and representation of system dynamics; sensitivity and model validation; models in scientific theory compared with decision-related modeling. Examples from a broad spectrum of application areas. Graduate Staff

BMA 691 Advanced Special Topics. *Preq.: CI. 1-3 F,S,Sum.* Directed readings, problem sets, written and oral reports as dictated by need and interest of student; new 600-level courses during the development phase (currently includes courses in systems modeling theory, biophysical theory and in physical theory). Graduate Staff

BMA 694 Seminar. *Prereq.: Grad. standing. 1(1-0) F,S.* Graduate students in biomathematics are expected to attend through most of their residence period.

Graduate Staff

BMA 699 Research. *Credits Arranged. F,S,Sum.*

Graduate Staff

Botany

GRADUATE FACULTY

Professor E. D. Seneca, Acting Head

Associate Professor T. E. Wynn, Graduate Administrator

Professors: C. E. Anderson, U. Blum, R. C. Fites, J. W. Hardin, R. L. Mott, E. C. Sisler, J. R. Troyer, A. M. Witherspoon; Professors (USDA): W. W. Heck, H. E. Pattee, H. Seltmann; Professors Emeriti: D. B. Anderson, G. R. Noggle, H. T. Scofield, L. A. Whitford; Associate Professors: R. L. Beckmann Jr., W. F. Boss, J. M. Stucky, C. G. Van Dyke, T. R. Wentworth; Assistant Professor: J. F. Thomas; Adjunct Assistant Professor: D. E. Blume

ASSOCIATE MEMBERS OF THE DEPARTMENT

Professors: A. W. Cooper, B. J. Copeland, R. J. Downs, M. M. Goodman, E. C. Sisler, R. J. Thomas, D. H. Timothy; Professors (USDA): S. C. Huber, D. E. Moreland; Associate Professors: H. V. Amerson, R. L. Hoffman; Assistant Professors (USDA): J. M. Anderson, K. O. Burkey, T. W. Rufty Jr.

The Department of Botany offers programs leading to the Master of Life Sciences (non-thesis), Master of Science and Doctor of Philosophy degrees.

Excellent physical facilities are available for instruction and research in all phases of the departmental program. The Phytotron (part of a two-unit controlled environment facility operated in collaboration with Duke University) offers opportunities for research in experimental taxonomy, ecology, morphology and plant physiology. The department supports a research program in plant cell and tissue culture. A herbarium supports studies in systematic botany, and is augmented by herbaria in the Departments of Botany at nearby Duke University and the University of North Carolina at Chapel Hill. Field laboratories are available at the coast, in the Piedmont and in the mountains. The department participates in tropical biology programs through university membership in the Organization for Tropical Studies.

All graduate students will participate at least one semester during a degree program in the departmental instructional program. Graduate students are expected to attend and participate in the seminar program every semester they are in residence.

SELECTED ADVANCED UNDERGRADUATE COURSES

BO 400 Plant Diversity. *Preq.: BO 200. 4(3-3) F.*

BO 403 Systematic Botany. *Preq.: BS 100 or 105 or BO 200. 4(2-4) S.*

BO 413 Introductory Plant Anatomy. *Preq.: BO 200 or equivalent. 3(2-3) S.*

BO (ZO) 414 Cell Biology. *Preqs.: CH 223, PY 212, ZO 201 or 203. 3(3-0) S.*

BO 421 Plant Physiology. *Preqs.: BS 100 or BS 105 or BO 200 and one year of college chemistry. 4(3-3) F,S.*

BO 499 Independent Study in Botany. *Preqs.: At least eight hours of Botany, advanced standing and presentation of plan of work approved by a faculty member. 1-3 F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

BO 510 Plant Anatomy. *Preq.: BO 200. 4(2-6) F.* A study of plant cells, ultrastructure, cell types, tissues, organs and patterns of growth and differentiation. Anderson

BO 522 Advanced Morphology and Phylogeny of Seed Plants. *Preq.: BO 403. 4(3-3) S. Alt. yrs.* A comprehensive survey of the morphology and evolution of angiosperms and gymnosperms. Special emphasis is given to vegetative and reproductive morphology of fossil and living forms, and to their presumed evolutionary relationships. (Offered 1986-87 and alt. years.) Hardin

BO 524 Grasses, Sedges and Rushes. *Preq.: BO 403. 4(2-6) F. Alt. yrs.* A course dealing with three large, economically and ecologically important plant families. A working familiarity will be achieved through an introduction to the special terminology used in dealing with these plants, extensive field work emphasizing species identification and a study of the modern classification of the grasses. (Offered 1987-88 and alt. years.) Stucky

BO (CS, ENT, PM, PP) 525 Biological Control. *4(3-3) Alt. F.* (See pest management.)

BO 544 Plant Geography. *Preqs.: BO 403, BO (ZO) 360, GN 411 or equivalents. 3(3-0) S. Alt. yrs.* A course in descriptive and interpretive plant geography, synthesizing data from the fields of ecology, genetics, geography, paleobotany and taxonomy. Includes a survey of the present distribution of major vegetation types throughout the world, a discussion of the history and development of this present pattern of vegetation and a discussion of the principles and theories of plant geography. (Offered 1987-88 and alt. years.) Seneca

BO (CS, GN, HS) 547 Cell and Tissue Techniques in Plant Breeding. *3I(1-4) F. Alt. yrs.* (See crop science.)

BO 551 Advanced Plant Physiology I. *Preqs.: General botany or biology and biochemistry. 3(3-0) F.* The first half of a two-semester sequence covering the field of plant physiology. Topics will include cellular transport, water relations, mineral relations, vascular transport and temperature relations. Troyer

BO 552 Advanced Plant Physiology II. *Preqs.: General botany or biology, introductory physiology and biochemistry. 3(3-0) S.* The second half of a two-semester sequence covering the field of plant physiology. Topics will include respiration, photosynthesis, nitrogen metabolism, growth and development. Boss

BO 553 Laboratory in Advanced Plant Physiology I. *Preq. or coreq.: BO 551, 1(0-3) F.*
Laboratory to accompany BO 551 Advanced Plant Physiology I Graduate Staff

BO 554 Laboratory in Advanced Plant Physiology II. *Preq. or coreq.: BO 552, 1(0-3) S.*
Laboratory to accompany BO 552 Advanced Plant Physiology II Graduate Staff

BO (ZO) 560 Principles of Ecology. *Preq.: Three semesters of college level biology courses, 4(3-3) F.* A consideration of the principles of ecology at the graduate level. Each of the major subject areas of ecology is developed in sufficient depth to provide a factual and philosophical framework for the understanding of ecology. Blum

BO 561 Physiological Ecology. *Preqs.: BO 421 and BO (ZO) 560 or equivalent, 4(3-3) S.*
Alt. yrs. The plant community is approached from a physiological standpoint. Emphasis will be placed on the individual in the community and how it responds to its immediate environment on short- and long-term bases. (Offered 1986-87 and alt. years.) Blum

BO 565 Plant Community Ecology. *Preq.: BO (ZO) 560 or BO (ZO) 360 or equivalent, 4(3-3) F.* Consideration of the structure and function of terrestrial vascular plant communities, with emphasis on both classical and recent research. Topics include measurement and description of community properties, classification, ordination, vegetation pattern in relation to environment, ecological succession and a survey of the vegetation of North America. (See biomathematics.) Wentworth

BO (BMA) 567 Modeling of Biological Systems. *4(3-2) F.* (See biomathematics.)

BO 570 Quantitative Ecology. *Preqs.: BO (ZO) 560 and ST 512 or equivalent, 3(3-0) F.* A course emphasizing the quantitative techniques and theories of vegetation analysis. Topics include sampling methodologies, the evaluation of sample adequacy, spatial patterns and species associations, the measurement and interpretation of ecological diversity, gradient analysis and classification of communities and plant population dynamics. Graduate Staff

BO (MB) 574 Phycology. *Preq.: BS 100 or BO 200, 3(1-4) S.* *Alt. yrs.* An introduction to the taxonomy, morphology, reproduction and ecological importance of organisms which may be included in the algae. Attention is given to the local freshwater flow and the physiology of selected species as it relates to algal blooms, water quality and nutrient loading in aquatic habitats. (Offered 1986-87 and alt. years.) Witherspoon

BO (MB, PP) 575 The Fungi. *Preq.: BO 200 or equivalent, 3(3-0) F.* An overview of the fungi within the framework of a survey of the major classes. Van Dyke

BO (MB, PP) 576 The Fungi—Lab. *Coreq.: BO 575, 1(0-3) F.* Illustrative material of the fungal assemblages discussed in BO 575. Van Dyke

BO 590 Topical Problems. *Preq.: CI, 1-3 F,S.* Discussions and readings on problems of current interest in the fields of ecology, anatomy and morphology, taxonomy, plant physiology and cell biology. May be repeated with a change in topic for a maximum of six credits. Graduate Staff

FOR GRADUATES ONLY

BO 612 Plant Morphogenesis. *Preq.: Six hours of botany equivalent to BO 400 and BO 421, 4(3-3) S.* *Alt. yrs.* A review and synthesis of the factors involved in the development of plant form. Tissue culture experiments will demonstrate levels of control from the molecular to the whole organism. (Offered 1987-88 and alt. years.) Mott

BO 620 Advanced Taxonomy. *Preq.: BO 403, 4(2-6) S. Alt. yrs.* Taxonomic principles and techniques including rules of nomenclature, literature, biosystematic methods, monographic techniques and concepts of categories. (Offered 1987-88 and alt. years.) Stucky

BO (PP) 625 Advanced Mycology. *4(2-6) F.* (See plant pathology.)

BO 631 Water Relations of Plants. *Preq.: BO 551 or equivalent, 3(3-0) S. Alt. yrs.* A discussion of the physiological water relations of plants with emphasis on theoretical principles and quantitative description. (Offered 1986-87 and alt. years.) Troyer

BO 633 Plant Growth and Development. *Preqs.: BO (ZO) 414 or BO 421, organic chemistry, 3(3-0) S.* An advanced course in plant physiology covering plant growth, development, differentiation, senescence and biological control mechanisms. Fites

BO 634 Introduction to the Thermodynamics of Biological Systems. *Preq.: BO 551 or CI, 3(3-0) S. Alt. yrs.* An introductory development of the thermodynamic theory relevant to biological systems together with consideration of examples of biological problems to which thermodynamic theory has been applied. (Offered 1987-88 and alt. years.) Troyer

BO 636 Discussions in Plant Physiology. *Preqs.: BO (ZO) 414 or BO 421, organic chemistry, 1(1-0) F,S.* Group discussions at an advanced level on selected topics. Graduate Staff

BO (ZO) 660 Advanced Topics in Ecology I. *Preq.: BO (ZO) 560, 4(3-3) S.* Subject matter in the major fields of ecology will be developed through seminars and lectures, and principles will be illustrated by laboratory exercises and field trips. Topics covered include microenvironment, population biology, community ecology, ecosystems and nutrient cycling. Graduate Staff

BO (ZO) 661 Advanced Topics in Ecology II. *4(3-3) S.* (See zoology.)

BO 662 Applied Coastal Ecology. *Preq.: BO (ZO) 360 or BO (ZO) 560, 3(3-0) S. Alt. yrs.* Course will cover the environmental factors, the vegetative communities, and man's influence on the ecology of the Coastal Plain of North Carolina. Emphasis will be placed on the coastal fringe (Outer Banks) and the problems involved in Coastal Zone Management. Course is field and problem oriented and is designed primarily for graduate students in environmentally-oriented programs. (Offered 1986-87 and alt. years.) Seneca

BO 691 Botany Seminar. *1(1-0) F,S.* Graduate Staff

BO 693 Special Problems in Botany. *Credits Arranged.* Directed research in some phase of botany other than a thesis problem, but designed to provide experience and training in research. Graduate Staff

BO 699 Research. *Credits Arranged. F,S.* Original research preliminary to writing a master's thesis or a doctoral dissertation. Graduate Staff

Chemical Engineering

GRADUATE FACULTY

Professor H. B. Hopfenberg, *Head*

Professor: R. M. Felder, *Graduate Administrator*

Professors: R. G. Carbonell, J. K. Ferrell, R. P. Gardner, D. B. Marsland, D. C. Martin, D. F. Ollis, M. R. Overcash, R. W. Rousseau, E. P. Stahel, V. T. Stannett; *Adjunct Professors:* F. O. Mixon, D. R. Squire; *Professors Emeriti:* K. O. Beatty Jr., R. Bright, J. F. Seely, H. B. Smith; *Associate Professors:* P. S. Fedkiw, C. K. Hall, P. K. Lim, C. J. Setzer, S. Torquato, H. M. Winston; *Adjunct Associate Professor:* J. L. Williams; *Assistant Professors:* C. M. Balik, R. T. Chern, D. E. Guinnup, P. K. Kilpatrick; *Lecturer:* W. E. Willis Jr.

The Department of Chemical Engineering offers programs of advanced study leading to the Master of Science, Master of Chemical Engineering and Doctor of Philosophy degrees. Students enrolling for graduate study in the department normally have a bachelor's degree in chemical engineering, but programs can be arranged to accommodate students with degrees in applied mathematics, chemistry, physics and other branches of engineering.

The department occupies 50,000 square feet in the Riddick Engineering Laboratories. Within the building are several general-purpose laboratories for graduate research, fully staffed machine and electronics shops, and a well-equipped instrumental analysis laboratory. A VAX 11-750 computer within the department and terminal links to larger mainframe computers provide outstanding programming and word processing capability.

Extensive research in the department is carried out by several faculty members in the areas of biotechnology and polymer and membrane science and engineering. Other active research areas include heterogeneous and homogeneous catalysis, chemical reaction engineering, fluid dynamics, mass transfer in porous media, solid waste managements, separate processes—particularly crystallization, distillation and membrane separation techniques, batch process simulation and optimization, phase equilibrium thermodynamics, statistical thermodynamics, interfacial phenomena and electrochemical engineering.

The proximity of UNC-Chapel Hill, Duke University and the Research Triangle Park lends considerable support to departmental research programs. The Environmental Protection Agency, for example, has its principal air pollution research facility in the Research Triangle Park, and arrangements can be made for graduate students studying air pollution problems to work at the EPA center under the joint direction of EPA and University staff members.

A brochure describing in greater detail opportunities for graduate study and research in chemical engineering as well as available fellowships and assistantships may be obtained upon request from the graduate administrator.

SELECTED ADVANCED UNDERGRADUATE COURSES

CHE 425 Process System Analysis and Control. *Preq.: CHE 225. 3(3-0) F.*

CHE 446 Design and Analysis of Chemical Reactors. *Preq.: CHE 315; Coreq.: CHE 316. 3(3-0) F.*

CHE 451 Chemical Engineering Design. *Preqs.: CHE 421, 446. 3(2-2) F,S.*

CHE (BAE) 465 Introduction to Biomedical Engineering. *Preqs.: MA 202 or 212, PY 212 or 208. 3(3-0) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

CHE 511 Chemical Engineering Process Modeling. *Preqs.: CHE 311, CHE 327, MA 301. 3(3-0) F.* Applications of the methods of mathematical analysis to the formulation and solution of problems in transport phenomena, process dynamics and chemical reaction engineering. Fedkiw, Felder

CHE 513 Thermodynamics I. *Preqs.: CHE 315, 316. 3(3-0) F.* Application of thermodynamic principles to problems arising in the chemical process industries. Chemical reactions and phase separation operations are viewed from a thermodynamic standpoint including consideration of their energy efficiencies. Hall, Kilpatrick,

CHE 515 Transport Phenomena. *Preqs.: CHE 311, 327. 3(3-0) S.* A theoretical unified study of transport of momentum, energy and matter. The diffusional operations are introduced in the light of the theory. Carbonell, Lim

CHE 516 Transport Phenomena II. *Preq.: CHE 515. 3(3-0) S.* Applications of the principles introduced in CHE 515. The applications discussed include multiphase flow and sedimentation, non-Newtonian and porous media flows, transport through membranes and in electrochemical systems and thermal instabilities. Carbonell

CHE 517 Chemical Reaction Engineering. *Preq.: CHE 446. 3(3-0) F.* Rates and mechanisms of homogeneous and heterogeneous reactions. Design, analysis and scale-up of batch and continuous chemical reactors. Felder, Stahel

CHE 521 Separation Processes. *Preq.: CHE 312. 3(3-0) S.* The theory and practice of staged multicomponent mass transfer operations and continuous rate processes. Problems unique to specific operations such as extractive and azeotropic distillation. Rousseau

CHE 525 Chemical Process Control. *Preq.: CHE 425. 3(3-0) S.* The application of control techniques to sampled data chemical process systems. Z-transform and state variable methods for the determination of open loop and closed loop system responses and for the synthesis of controller algorithms. Hybrid computer simulation and control of on-line real time processes. Ferrell, Winston

CHE (OR) 527 Optimization of Engineering Processes. *Preqs.: CHE 451 or OR 501, FORTRAN programming. 3(3-0) F.* The formulation and solution of process optimization problems, with emphasis on nonlinear programming techniques. Computer implementation of optimization algorithms, on-line optimization, simulation methods and structuring of process models to increase computational efficiency. Felder

CHE 535 Engineering Economy in Air Pollution Control Systems. *Preqs.: MAE 409, CE 576 or equivalent first course. 3(3-2) F.* Design of equipment for the abatement of air pollution; estimation of capital cost and operating expenses; economic optimization under various kinds of tax laws. Marsland

CHE 543 Technology of Polymers. *Preq.: CHE 223. 3(3-0) S.* Concepts and techniques of macromolecule characterization. Structure, properties, fabrication technology and applications of commercially important polymers. Chern

CHE 561 Biomedical Engineering I: Fluid Flow and Heat Transfer. *Preq.: CHE (BAE) 465 or equivalent background. 3(3-0) S.* The physiology requisite to modeling and analysis of mammalian systems, coupled with the engineering approach to the biomedical problems of flow of fluids (blood, lymph, air, etc.) in the body and thermal transport from the body surfaces. Beatty, Richardson

CHE (TC) 569 Polymers, Surfactants and Colloidal Materials. *Preqs.: CHE 316, CH 223. 3(3-0) F.* Relationships between molecular structure and bulk properties of nonmetallic materials applied to commercial products and chemical engineering processes. Applications of surface and colloid chemistry and polymer science to product development and process improvement. Hopfenberg

CHE (TC) 570 Radiation Chemistry and Technology of Polymeric Systems. *Preqs.: CH 221, 431. 3(3-0) S.* Principles and practice of isotope and electron beam radiation treatment. Applications of high energy radiation in polymer chemistry and technology, including the use of radiation to cross-link and degrade polymers. Similarities and differences between radiation polymerization and photopolymerization. Stannett, Williams

CHE 597 Chemical Engineering Projects. *Preq.: Grad. standing. 1-3 F,S.* Independent study of some phase of chemical engineering or a related field. Graduate Staff

CHE 598 Special Topics in Chemical Engineering. *Preq.: Grad. standing. 1-3 F,S.* Directed reading of the chemical engineering literature, introduction to research methodology, and lectures and seminar discussion on topics which vary from term to term. Graduate Staff

FOR GRADUATES ONLY

CHE 611 Chemical Process Design and Simulation. *Preq.: CHE 511. 3(3-0) S.* Application of process analysis, simulation and optimization techniques to case studies of complex chemical processes. Felder, Marsland

CHE 613 Thermodynamics II. *Preq.: CHE 513. 3(3-0) S.* Topics in chemical engineering thermodynamics and selected for study in accord with the interests of the class. Irreversible thermodynamics, thermodynamics of polymers and membrane transport, and improvement of thermodynamic efficiencies of unit operations are represented topics. Hall, Kilpatrick

CHE 617 Advanced Chemical Reaction Engineering. *Preq.: CHE 517. 3(3-0) S.* Topics relating to the design, analysis and operation of homogeneous and heterogeneous chemical reactors. Ollis, Stahel

CHE 619 Electrochemical Systems Analysis. *Preqs.: CHE 515, 517 or CI. 3(3-0) S. Alt. yrs.* Electrochemical thermodynamics, electrochemical kinetics and catalysis, coupled charge and material transport in an electric field and electrophoretic effects. Design and analysis of electrochemical reactors. Survey of electrochemical industry. Fedkiw

CHE 621 Advanced Mass Transfer. *Preqs.: CHE 515, 521. 3(3-0) Alt. F.* Applications of transport theory to the analysis, synthesis and design of mass-transfer equipment. Principles and design of absorption, extraction, distillation, humidification and drying operations. Rousseau

CHE 623 Advanced Fluid Dynamics. *Preqs.: CHE 515, 523. 3(3-0) S.* The principles of fluid dynamics and their application to laminar and turbulent flow, flow in closed channels, flow in packed beds and porous media, particle technology, industrial rheology and two-phase flow. Carbonell

CHE 624 Advanced Heat Transfer. *Preq.: CHE 515, 523. 3(3-0) Alt. S.* Heat transfer between liquids and solids, optimum operating conditions and design of equipment, conduction, heating and cooling of solids, and radiant heat transmission. Ferrell

CHE (TC) 669 Diffusion in Polymers. *Preq.: CHE 569 or CI. 2(2-0) S.* The theory of small molecule transport in polymers; applications of membrane transport processes in the chemical, polymer, textile, coatings and natural fiber industries. Chern, Hopfenberg

CHE (TC) 671 Special Topics in Polymer Science. *Preq.: Cl. 1-3 F.* An intensive treatment of topics in fiber and polymer science and technology selected in accord with the interests of the class. Stannett

CHE 693 Advanced Topics in Chemical Engineering. *1-3 F,S.* Recent developments in chemical engineering theory and practice. The topics will vary from term to term. Graduate Staff

CHE 695 Seminar. *1(1-0) F,S.* Weekly seminars on topics of current interest given by resident faculty members, graduate students and visiting lecturers. Graduate Staff

CHE 697 Advanced Chemical Engineering Projects. *Preq.: Grad. standing in CHE. 1-3 F,S, Sum.* Independent study of some phase of chemical engineering or a related field. Graduate Staff

CHE 699 Research. *Credits Arranged. F,S.* Individual research in chemical engineering. A report on this research is required as a graduate thesis. Graduate Staff

Chemistry

GRADUATE FACULTY

Professor K. W. Hanck, Head

Professor C. G. Moreland, Assistant Head for Graduate Studies

Professor M. L. Miles, Assistant Head for Business Affairs

Professor W. P. Tucker, Assistant Head for Undergraduate Studies

Professors: K. J. Bachmann, H. A. Bent, R. D. Bereman, L. H. Bowen, C. L. Bumgardner, H. H. Carmichael, M. K. DeArmond, L. D. Freedman, F. W. Getzen, F. C. Hentz Jr. Z Z. Hugus Jr., L. A. Jones, S. G. Levine, G. G. Long, A. F. Schreiner, L. B. Sims, G. H. Wahl Jr.; *Adjunct Professor:* M. E. Wall; *Professors Emeriti:* G. O. Doak, R. H. Loeppert, W. A. Reid, P. P. Sutton, R. C. White; *Associate Professors:* C. B. Boss, T. C. Caves, A. F. Coots, Y. Ebisuzaki, S. T. Purrington, W. L. Switzer, D. W. Wertz, M. Whangbo; *Associate Professor Emeritus:* T. M. Ward; *Assistant Professors:* E. F. Bowden, R. J. Linderman

The Department of Chemistry offers programs leading to the Master of Chemistry, Master of Science and Doctor of Philosophy degrees. Major fields of specialization are analytical, inorganic, organic, nuclear and physical chemistry. A wide variety of advanced courses and a broad spectrum of research topics provide preparation for almost every type of position open to a chemist with an advanced degree.

A student entering graduate work in chemistry should have a bachelor's degree in chemistry or its equivalent. This includes the equivalent of one-year courses in general, organic, physical and analytical chemistry and a semester of inorganic chemistry. At least one year of college physics and two years of mathematics, in-

cluding differential equations, are necessary. Students who fail to meet these requirements may in some cases be admitted on a provisional basis.

With a large graduate faculty and favorable graduate student to faculty ratio, the chemistry department emphasizes individual attention, small classes and personal collaboration on research with faculty members. Among the variety of active research projects available for thesis work are organic and inorganic synthesis, synthesis/characterization of semiconductors, structure and properties of organometallic compounds and transition metal complexes, stereochemistry, crystallography, kinetics, radiochemistry, electrochemistry, micro and trace analysis, atomic and plasma spectroscopy, micro computer and statistical applications, quantum chemistry, and infrared, Raman, Mossbauer, nuclear magnetic resonance, nuclear quadrupole resonance, electron spin resonance, and natural and magnetic circular dichroism spectroscopy.

The department is equipped with standard instruments and apparatus for teaching and research. Many items of specialized equipment are available including recording spectrophotometers covering the range from far infrared to ultraviolet, nuclear magnetic resonance spectrometers, liquid chromatographs, gas chromatographs, mass spectrometer, atomic absorption spectrophotometers, electron spin resonance spectrometer, nuclear quadrupole resonance spectrometer, Mossbauer spectrometer, DC plasma spectrometer and X-ray diffractometer. Facilities for interfacing laboratory instruments and computers are available. The department's research activities are housed in a nine-story building and supported by glass, machine and electronic shops.

The department has available for qualified applicants teaching and research assistantships, as well as a number of fellowships.

SELECTED ADVANCED UNDERGRADUATE COURSES

CH 401 Systematic Inorganic Chemistry. *Coreq.: CH 431 or CH 331. 3(3-0) S.*

CH 411 Analytical Chemistry I. *Preq.: CH 434. 4(2-6) F.*

CH 413 Analytical Chemistry II. *Preq.: CH 411. 4(2-6) S.*

CH 428 Qualitative Organic Analysis. *Preq.: CH 223. 3(1-6) F,S.*

CH 431 Physical Chemistry I. *Preqs.: CH 107, MA 202, PY 203 or 208; Coreq.: MA 301. 3(2-1) F,S,Sum.*

CH 433 Physical Chemistry II. *Preqs.: CH 431 and MA 301. 3(2-1) F,S.*

CH 434 Physical Chemistry II Laboratory. *Preq.: CH 431; Coreq.: CH 433. 2(0-4) S.*

CH 435 Physical Chemistry III. *Preqs.: CH 431 and MA 301. 3(3-0) F.*

CH (TC) 461 Introduction to Fiber-Forming Polymers. *Preq.: CH 223. 3(3-0) F.*

CH 490 Chemical Preparations. *Preq.: Three years of CH. 3(0-9) F,S.*

CH 493 Chemical Literature. *Preq.: Three years of CH. 1(1-0) F.*

CH 499 Senior Research in Chemistry. *Preq.: Three years of CH. Credits Arranged. 1-3 F,S,Sum.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

CH 501 Advanced Inorganic Chemistry I. *Preq.: CH 433 or grad. standing. 3(3-0) F.* This course introduces symmetry, point groups and group theory. The major part of the course is devoted to a systematic description of the chemistry of transition elements (3d, 4d, 5d; lanthanides) and selected representative elements. Pertinent introductory discussions of electronic and magnetic structural information will be included.

CH 502 Inorganic Syntheses and Measurements. *Preq.: CH 401. 2(0-6) F.* Synthetic methods in inorganic chemistry, including high-temperature, electrolytic, inert-atmosphere, vacuum line and solvent-system methods. Separation and characterization techniques for inorganic systems will be widely employed.

CH 503 Advanced Inorganic Chemistry II. *Preq.: CH 501. 3(3-0) S.* This course builds on and is a continuation of CH 501. It will include topics from organometallic, photochemical, reaction mechanism and bio-inorganic areas.

CH 505 Physical Methods in Inorganic Chemistry. *Preqs.: Grad. standing and CH 501 or CI. 3(3-0) S.* The course will describe the use of group, molecular orbital and ligand field theories for spectroscopy and bonding; measurement methodology and the significance of experimental parameters, including electronic, photoluminescence, photoelectron, vibrational spectroscopies, magnetic susceptibility, Mossbauer, esr, nmr, nqr and x-ray structure determinations.

CH 515 Chemical Instrumentation. *Preq.: CH 431; Coreq.: CH 411. 3(3-0) S.* Basic electronic components and circuits, the response of laboratory instruments, design and modification of typical electronic control and measurement systems. Emphasis will be placed on the transducers and control elements utilized in chemical research.

CH 517 Physical Methods of Elemental Trace Analysis. *Preq.: CH 315 or 331 or CI. 3(3-0) F.* The principles and applications of currently used methods of trace analysis are presented. Designed for students with little or no experience in trace analysis but with a strong interest in or need for analytical data at the trace level. Topics include pulse polarography, potentiometry, UV-Vis spectrophotometry, atomic absorption, emission spectrometry, fluorescence, neutron activation analysis and spark source mass spectrometry.

CH 518 Trace Analysis Laboratory. *Coreq.: CH 517 or CI. 2(0-6) F.* The trace element content of samples is determined by a variety of instrumental techniques including UV-Vis spectrophotometry, fluorescence, emission spectrometry, atomic absorption, pulse polarography and neutron activation analysis.

CH 521 Advanced Organic Chemistry I. *Preqs.: CH 223, 433 or 435. 3(3-0) F.* Structure stereochemistry and reactions of the various classes of hydrocarbons. The molecular orbital treatment of bonding and reactivity of alkenes, the conformational interpretation of cycloalkene and cycloalkene reactivity and the application of optical isomerism to the study of reaction mechanisms will be emphasized.

CH 523 Advanced Organic Chemistry II. *Preq.: CH 521. 3(3-0) S.* An introduction to acid-base theory and mechanistic organic chemistry as applied to synthetically useful organic reactions.

CH 525 Physical Methods in Organic Chemistry. *Preqs.: CH 223 and 433 or 435. 3(3-0) S.* Application of physical methods to the solution of structural problems in organic chemistry. Emphasis will be on spectral methods including infrared, ultraviolet, nuclear magnetic resonance, mass spectrometry, electron paramagnetic resonance, X-ray and electron diffraction and optical rotatory dispersion.

CH 530 Advanced Physical Chemistry. *Preq.: Grad. standing or CI. 3(3-0) F.* A survey of chemical thermodynamics and kinetics, with emphasis on reactions in the liquid phase. Problem solving is an important part of the course. Designed to review and to expand on materials usually covered in a one-year undergraduate physical chemistry course.

CH 531 Chemical Thermodynamics. *Preqs.: CH 433, MA 301. 3(3-0) F.* An extension of elementary principles to the treatment of ideal and real gases, ideal solutions, electrolytic solutions, galvanic cells, surface systems and irreversible processes. An introduction to statistical thermodynamics and the estimation of thermodynamic functions from spectroscopic data.

CH 533 Chemical Kinetics. *Preqs.: CH 433, MA 301. 3(3-0) S. Alt. yrs.* An intensive survey of the basic principles of chemical kinetics with emphasis on experimental and mathematical techniques, elements of the kinetic theory and theory of the transition state. Applications to gas reactions, reactions in solution and mechanism studies.

CH 535 Surface Phenomena. *Preqs.: CH 433, MA 301. 3(3-0) S. Alt. yrs.* An intensive survey of the topics of current interest in surface phenomena. Formulations of basic theories are presented together with illustrations of their current applications.

CH 536 Chemical Spectroscopy. *Preq.: CH 435. 3(3-0) S. Alt. yrs.* Introduction to rotational, vibrational and electronic molecular spectroscopy from a quantum mechanical viewpoint. Emphasis on the elucidation of structure, bonding and excited state properties of organic and inorganic molecules.

CH 537 Quantum Chemistry. *Preqs.: MA 301, CH 435 or PY 407. 3(3-0) S.* The elements of wave mechanics applied to stationary energy states and time dependent phenomena. Applications of quantum theory to chemistry, particularly chemical bonds.

CH 539 Colloid Chemistry. *Preqs.: CH 220, 315 or 331, or CI. 3(2-3) S. Alt. yrs.* Theories, basic principles and fundamental concepts including preparation and behavior of sols, gels, emulsions, foams and aerosols and topics in areas of adsorption, Donnan equilibrium dialysis and small-particle dynamics. Laboratory includes independent project studies in specialized areas.

CH 541 Nuclear Chemistry. *Preq.: CH 433 or PY 410. 3(2-3) S. Alt. yrs.* The basic aspects of nuclear chemistry including: (i) nuclear reactions and energy levels, (ii) the types and energetics of radioactive decay, (iii) the formation and properties of radioactive elements, (iv) the effect of individual isotopes on chemical and physical properties and (v) the effects of nuclear radiation on matter.

CH (TC) 562 Physical Chemistry of High Polymers—Bulk Properties. *3(3-0) F.* (See textile chemistry.)

CH 595 Special Topics in Chemistry. *Preq.: CI. 1-3 F,S.* Detailed study of a particular problem or technique pertaining to chemistry.

FOR GRADUATES ONLY

CH 613 Electrochemistry. *Preq.: CH 433. 3(3-0) S. Alt. yrs.* The thermodynamics and kinetics of electrode reactions are presented as well as the experimental methods for study-

ing them. Particular emphasis is placed on the measurement of standard potential and establishing the number of electrons transferred. Applications of electrochemistry in the production/storage of energy and in chemical analysis are discussed.

CH 625 Organic Reaction Mechanisms. *Preqs.: CH 523, CH 433. 3(3-0) S.* A study of the effects of structure and substituents on the direction and rates of organic reactions.

CH 627 Chemistry of Metal-Organic Compounds. *Preq.: CH 521. 3(3-0) F.* Preparation, properties and reactions of compounds containing the carbon-metal bond with a brief description of their uses.

CH 631 Chemical Thermodynamics II. *Preq.: CH 531. 3(3-0) S. Alt. yrs.* Statistical interpretation of thermodynamics; use of partition functions; introduction to quantum statistics; application of statistical mechanics to chemical problems, including calculation of thermodynamic properties, equilibria and rate processes.

CH (BCH) 659 Natural Products. *Preqs.: CH 523, 525 or CI. 3(3-0) F.* Illustrative studies of structure determination, synthesis and biosynthesis of natural substances. Modern physical methods and fundamental chemical concepts are stressed. Examples are chosen from such classes as alkaloids, terpenes, steroids and antibiotics.

CH 691 Seminar. *Preq.: Grad. standing in CH. 1(1-0) F,S.* Scientific articles, progress reports on research and special problems of interest to chemists are reviewed and discussed.

CH 695 Advanced Topics in Chemistry. *Preq.: CI. Maximum 3 F,S.* Critical study in one of the branches of chemistry.

CH 699 Chemical Research. *Preq.: Grad. standing in CH. Credits Arranged. F,S.* Special problems that will furnish material for a thesis. A maximum of six semester credits is allowed toward a master's degree; there is no limitation on credits in the doctoral program.

Civil Engineering

GRADUATE FACULTY

Professor P. Z. Zia, Head

Professor H. E. Wahls, Associate Head, Graduate Program

Professor C. L. Heimbach, Associate Head, Undergraduate Programs

Professors: M. Amein, P. D. Cribbins, R. A. Douglas, J. F. Ely, W. S. Galler, A. K. Gupta, K. S. Havner, Y. Horie, J. W. Horn, D. W. Johnston, L. J. Langfelder, P. H. McDonald, C. C. Tung; *Adjunct Professors:* R. C. Heath, L. E. King; *Professors Emeriti:* W. F. Babcock, R. E. Fadum, A.-A. I. Kashef, S. W. Nunnally, C. Smallwood Jr., M. E. Uyanik; *Associate Professors:* W. L. Bingham, R. H. Borden, A. C. Chao, J. S. Fisher, E. D. Gurley, N. P. Khosla, H. R. Malcom Jr., V. C. Matzen, J. C. Smith, J. R. Stone; *Adjunct Associate Professor:* J. E. Tidwell; *Assistant Professors:* S. H. Ahmad, P. C. Lambe, J. M. Nau, M. F. Overton, M. S. Rahman, W. J. Rasdorf

The Department of Civil Engineering offers programs of study leading to the Master of Civil Engineering, Master of Science and Doctor of Philosophy degrees. Students may major in construction engineering, geotechnical engineering, structural engineering and mechanics, transportation engineering, coastal and ocean engineering, or sanitary and water resources engineering.

The Master of Civil Engineering degree is a non-thesis program emphasizing engineering design and practice. The program of study must include a minimum of three credit hours of independent study with a final written report. The Master of Science degree requires a thesis for which no more than six semester hours of credit may be used to satisfy the minimum degree requirements. For both degrees, the major and supporting areas of study may be selected from specialty areas within the Department of Civil Engineering. Both degrees require a final oral examination.

For the doctoral program, there are no definite requirements in credit hours. The coursework usually requires about one year of full-time study beyond the master's degree. The major element of the doctoral program is the dissertation, which reports an original investigation that represents a significant contribution to knowledge.

The faculty is engaged in broad research areas including deterministic and probabilistic structural theories and mechanics, fundamental behavior of soils and structures, computer-aided design, artificial intelligence, highway safety, land use and urban planning, hydraulics and hydrology, coastal processes, materials, construction engineering and management, waste disposal and pollution control. Many of the investigations are sponsored by industries and federal and state agencies including the continuing cooperative highway research program.

The department cooperates with other University divisions in joint programs. Qualified students may schedule courses in this department and in the Department of City and Regional Planning at the University of North Carolina at Chapel Hill to receive a dual degree, a Master of Science with a major in transportation engineering and a Master of Regional Planning. Multidisciplinary study and research programs are also available through the North Carolina Institute for Transportation Research and Education, Water Resources Research Institute and the North Carolina Sea Grant Program.

Students in other disciplines may develop minor areas of study within the framework of departmental course offerings. In particular, courses of instruction in stream sanitation and industrial waste disposal provide the types of training in pollution often in demand by industry.

A brochure and supplementary information on graduate study, research and assistantships and fellowships are available upon request from the graduate administrator of the Department of Civil Engineering. For applicants without a degree from a U.S. institution, GRE scores are required to expedite consideration for admission and financial aid. This requirement may be waived upon written request for applicants with an exceptional scholastic record.

SELECTED ADVANCED UNDERGRADUATE COURSES

CE 406 Transportation Engineering II. *Preq.: CE 305, 3(3-0) F.*

- CE 425 Intermediate Structural Analysis.** *Preq.: CE 325. 3(3-0) S.*
- CE 427 Structural Engineering II.** *Preq.: CE 326. 3(2-2) F.*
- CE 428 Structural Design in Wood.** *Preq.: CE 326. 3(2-2) S.*
- CE 443 Soil Engineering II.** *Preq.: CE 342. 3(3-0) F.*
- CE 463 Cost Analysis and Control.** *Preq.: CE 365. 3(2-3) F.*
- CE 464 Legal Aspects of Contracting.** *Preq.: Sr. standing. 3(3-0) S.*
- CE 466 Construction Engineering II.** *Preqs.: CE 326, 365. 3(2-3) F.*
- CE 484 Water Resources Engineering II.** *Preq.: CE 383. 3(3-0) F.*
- CE 498 Special Problems in Civil Engineering.** *Preq.: Sr. standing. 1-4 F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

CE 501 Transportation Systems Analysis. *Preq.: CE 406. 3(3-0) F.* Application of systems analysis to multi-modal transportation studies. Covers the analysis, planning and design of transport facilities for both the public and private sectors. Planning is discussed from the short-run as well as the long-run perspective. Heimbach

CE 502 Transportation Operations. *Preq.: CE 406. 3(3-0) S.* The analysis of traffic and transportation engineering operations. Graduate Staff

CE 503 Transportation Design. *Preq.: CE 406. 3(2-3) S.* The geometric elements of traffic and transportation engineering design. Cribbins, Horn

CE 504 Water Transportation. *Preq.: CE 305. 3(3-0) F.* The planning, design, construction and operation of waterways, ports, harbors and related facilities. Development of analytical techniques for evaluating the feasibility of piers, ports and multipurpose river basin projects. The design of marine structures and civil works that are significant in civil engineering, including locks, dams, harbors, ports and contractive and protective works. Cribbins

CE 505 Mass Transportation. *Preq.: CE 406. 3(3-0) S.* Definition of the characteristics, trends, issues and technologies related to mass transportation, and the identification of methodologies applicable to the planning, design and management of mass transportation systems. This includes applications to the urban, inter-urban and rural settings for both short- and long-range planning horizons. Stone

CE 506 Municipal Engineering Projects. *Preq.: Sr. standing in CE or CEC. 3(2-3) S.* Special problems relating to public works, public utilities, urban planning and city engineering. Horn

CE 507 Airphoto Analysis I. *Preq.: Sr. standing. 3(2-3) S.* Principles and concepts for engineering evaluation of aerial photographs, including analysis of soils and surface drainage characteristics. Wahls

CE 511, 512 Continuum Mechanics I, II. *Preqs.: CE 313 or MAE 314, CE 382 or MAE 308, MAE 301, MA 405. (511) 3(3-0) F; (512) 3(3-0) S. Alt. yrs.* The concepts of stress and strain are presented in generalized tensor form. Emphasis is placed on the discussion and relative comparisons of the analytical models for elastic, plastic, fluid, viscoelastic, granular and porous

media. The underlying thermodynamic principles are presented, the associated boundary value problems are formulated and selected examples are used to illustrate the theory.

McDonald

CE 513 Theory of Elasticity I. *Preq.: CE 313 or MAE 314. 3(3-0) S.* The fundamental equations governing the behavior of an elastic solid are developed in various curvilinear coordinate systems. Plane problems, as well as the St. Venant problem of bending, torsion and extension of bars are covered. Displacement fields, stress fields, Airy and complex stress functions are among the methods used to obtain solutions.

Douglas, Gurley, Horie

CE 514 Stress Waves. *Preqs.: MA 301; CE 313 or PY 411 or MA 401 or MEA 351. 3(3-0) F. Alt. yrs.* Introduction to the theory of stress waves in solids. Origins and nature of longitudinal transverse and surface waves originating at an impact site or from other transient disturbances. Determination of stresses, particle velocities, wave velocities. Introduction to wave interaction with other waves and with boundaries and dissimilar materials. Introduction to modern instrumentation and seismic refraction exploration.

Douglas

CE 521 Advanced Strength of Materials. *Preq.: CE 313 or MAE 314. 3(3-0) F.* Stresses and strains at a point: rosette analysis; strength theories, stress concentration and fatigue; torsion and unsymmetrical bending of open and closed sections; inelastic, composite and curved beams; energy methods; shear deflections; and membrane stresses in shells.

Graduate Staff

CE 522 Elastic Stability. *Preqs.: CE 521, MA 301, 405. 3(3-0) S.* A study of elastic and plastic stability. The stability criterion as a determinant. The energy method and the theorem of stationary potential energy. The solution of buckling problems by finite differences and the calculus of variations. The application of successive approximations to stability problems.

Graduate Staff

CE 524 Analysis and Design of Masonry Structures. *Coreq.: CE 427. 3(3-0) F. Alt. yrs.* Theory and design of masonry arches, culverts, dams, foundations and masonry walls subjected to lateral loads.

Graduate Staff

CE 525 Matrix Structural Analysis. *Preq.: CE 425. 3(3-0) F.* Direct formulation of the banded system stiffness matrix and loading vectors for a first order Displacement Method analysis of two- and three-dimensional structural frames, trusses and grids; analysis by sub-structures; effects of prestrain, temperature, support settlements, shear deformations and joint deformations; second order analysis; computer applications using existing computer programs.

Smith

CE 526 Finite Element Methods for Civil Engineering. *Preqs.: CE 425 and prior programming knowledge. 3(3-0) S.* A basic course in finite element method for civil engineering. Development, theory and formulation of various finite elements. On-hand finite element computer programming. On-hand finite element analysis of civil engineering problems, such as dam structures, hyperbolic cooling towers, slabs and soil-structure interaction problems.

Gupta

CE 527 Analysis and Design of Structures for Dynamic Loads. *Preq. or coreq.: CE 525. 3(3-0) F.* Analysis and design of single and multi-degree-of-freedom structures subjected to various types of excitations and initial conditions. Computational aspects of dynamic analysis. Introduction to nonlinear analysis techniques and to approximate methods of analysis. Consideration of strong motion earthquakes. Study of earthquake regulations in building codes.

Matzen

CE 531 Structural Models. *Preq.: CE 427. 3(2-3) F.* Dimensional analysis and structural similitude, indirect and direct models, model materials and experimental techniques, individual project in structural model analysis.

Bingham, Matzen

CE 534 Plastic Analysis and Design. *Preq.: CE 427. 3(3-0) S.* Theory of plastic behavior of steel structures; concept of design for ultimate load and the use of load factors. Analysis and design of components of steel frames including bracings and connections. Ely, Smith

CE 536 Theory and Design of Prestressed Concrete. *Coreq.: CE 427. 3(3-0) F.* The principles and concepts of design in prestressed concrete including elastic and ultimate strength analyses for flexure, shear, torsion, bond and deflection. Principles of concordancy and linear transformation for indeterminate prestressed structures. Application of prestressing to tanks and shells. Ahmad, Zia

CE (MEA) 541 Gravity Wave Theory I. *3(3-0) S.* (See marine, earth and atmospheric sciences.)

CE 543 Hydraulics of Ground Water. *Preq.: CE 382 or 342 or equivalent. 3(3-0) S.* Principles of ground water hydraulics; theory of flow through idealized porous media; the flow net solution; seepage and well problems. Lambe, Rahman

CE 544 Foundation Engineering. *Preq.: CE 342. 3(3-0) S.* Subsoil investigations; excavations; design of sheeting and bracing systems; control of water; footing, grillage and pile foundations; caisson and cofferdam methods of construction. Borden, Lambe

CE 548 Engineering Properties of Soils I. *Preq.: CE 342. 3(2-3) F.* The study of soil properties that are significant in earthwork engineering, including properties of soil solids, basic physiochemical concepts, classification, identification, plasticity; permeability, capillarity and stabilization. Laboratory work includes classification, permeability and compaction tests. Borden

CE 549 Engineering Properties of Soils II. *Preq.: CE 548. 3(2-3) S.* Continuation of CE 548, including the study of compressibility, stress-strain relations and shear strength theories for soil. Laboratory work includes consolidation and shear strength tests. Borden

CE 551 Theory of Concrete Mixtures. *Preq.: CE 332. 3(3-0) F.* A study in depth of the theory of portland cement concrete mixtures including types and properties of portland special cements; chemical reactions; brief examination of history of mixture design; detailed study of current design methods; properties of fresh and hardened concretes; strength-age-curing relationships; durability; admixtures; special concretes; production and quality control. Graduate Staff

CE 553 Asphalt and Bituminous Materials. *Preq.: CE 332. 3(2-3) S.* A study in depth of properties of asphalts and tars for use in waterproofing and bituminous materials, and theories of design of bituminous mixtures for construction and paving uses including types and properties of asphalt cements, cutbacks, emulsions, blown asphalts and tars; brief examination of historical developments; detailed study of properties and design of bituminous mixtures; and current research. Laboratory work includes standard tests on asphalts, tars and road oils; design, manufacture and testing of trial batches; and current research techniques. Khosla

CE 555 Highway and Airport Pavement Design. *Preq.: CE 406 or 443. 3(2-3) F.* Theoretical analysis and design of highway and airport pavements with critical evaluation of current design practices. Khosla

CE 561 Construction Planning and Scheduling. *Preq.: CE 463. 3(3-0) F.* Construction project planning, scheduling and control utilizing network methods. Both manual and computer techniques will be applied. Introduction to other quantitative management methods in construction. Utilizing the principles developed, students will bid, plan, schedule and manage a construction project under competitive conditions in a computer-simulated environment. Graduate Staff

CE 562 Construction Productivity. *Preq.: CE 463 or equivalent. 3(3-0) F.* Methods of collecting, assembling and analyzing construction productivity data in order to increase construction productivity. Applications of methods improvement techniques such as time-lapse photography, flow charts, process charts and time standards to the improvement of construction productivity. Safety and human factors in construction and their relation to construction productivity. Graduate Staff

CE 566 Building Construction Systems. *Preq.: CE 466 or CE 427 or grad. standing in ARC. 3(3-0) S.* Construction engineering of conventional and industrialized building systems. Emphasis in the areas of structural systems utilizing cast-in-place concrete, precast concrete, prestressed concrete, structural steel, cold-formed steel, masonry, timber, composite and mixed materials. Topics include mechanisms for resisting and transmitting loads, detailing, fabrication, transportation, erection, stability, shoring, quality control and integration of service systems. Johnston

CE (BAE, MB) 570 Sanitary Microbiology. *Preq.: MB 401 or equivalent. 3(2-3) S.* Fundamental aspects of microbiology and biochemistry are presented and related to problems of stream pollution, refuse disposal and biological treatment. Laboratory exercises present basic microbiological techniques and illustrate from a chemical viewpoint some of the basic microbial aspects of waste disposal. Chao

CE 571 Theory of Water and Waste Treatment. *Preq.: Grad. standing. 3(3-0) F.* Study of the basic physical and chemical processes underlying water and waste treatment, including mass transfer, equilibria, and kinetics. Galler

CE 572 Design of Water and Wastewater Facilities. *Preq.: CE 571. 3(3-0) S.* Theory and design of water and wastewater treatment plants. Chao

CE 573 Unit Operations and Processes in Waste Treatment. *Preq.: CE 486; Coreq.: CE 571. 3(1-6) F.* Unit operations and processes in water and wastes engineering, including sedimentation, thickening, chemical coagulation, vacuum filtration, carbon adsorption, biological treatment, and special projects. Chao, Galler

CE 575 Civil Engineering Systems. *Preq.: MA 405. 3(3-0) S.* An examination of civil engineering systems and their design optimization. The systems to be studied include water resources engineering, structural engineering, transportation engineering and construction. Galler

CE 576 Atmospheric Pollution. *Preq.: Grad. or advanced undergrad. standing. 3(3-0) S.* A survey of the problem of atmospheric pollution. Topics to be discussed include: pollutant sources; effects on man and other animals, vegetation, materials and visibility; meteorological factors, air sampling; control devices; air quality and emission standards; and legal, economic and administrative aspects. Graduate Staff

CE (BAE) 578 Agricultural Waste Management. *3(2-3) F.* (See biological and agricultural engineering.)

CE 580 Flow in Open Channels. *Preq.: CE 382. 3(3-0) F.* The theory and applications of flow in open channels, including dimensional analysis, momentum-energy principle, gradually varied flow, high-velocity flow, energy dissipators, spillways, waves, channel transitions and model studies. Amein

CE 582 Coastal Hydrodynamics. *Preq.: CE 382 or equivalent. 3(3-0) F.* Surface gravity waves, solitary waves, longwaves, impulsively generated waves, flow in inlets and estuaries, storm surge, wave refraction and diffraction, harbor oscillations. Overton

CE 583 Engineering Aspects of Coastal Processes. *Preq.: CE 382 or equivalent; Coreq.: MEA (CE) 541. 3(3-0) S.* Coastal environment, engineering aspects of the mechanics of sediment movement, littoral drift, beach profiles, beach stability, meteorological effects, tidal inlets, inlet stability, shoaling, deltas, beach nourishment, mixing processes, pollution of coastal waters, interaction between shore processes and man-made structures, case studies.

Fisher

CE 585 Urban Stormwater Management. *Preq.: CE 383. 3(3-0) F.* Studies of stormwater management in urban areas emphasizing quantitative problems in flooding, sedimentation and water quality. Review and extension of design concepts involving channels and impoundments. Survey of hydrographic formation techniques and examination of common hydrologic models. Case studies of urbanizing watersheds.

Malcom

CE 589 Special Topics in Civil Engineering. *3(3-0) F,S.* New or special course on recent developments in some phase of civil engineering. Specific topics and prerequisites are identified for each section and will vary from term to term.

Graduate Staff

CE 591, 592 Civil Engineering Seminar. *1(1-0) F,S.* Discussions and reports of subjects in civil engineering and allied fields.

Graduate Staff

CE 598 Civil Engineering Projects. *1-6 F,S.* Research- or design-oriented independent study and investigation of a specific civil engineering topic, which culminates in a final written report. A minimum of three credits required for the MCE degree.

Graduate Staff

FOR GRADUATES ONLY

CE 601 Transportation Planning. *Preq.: CE 502. 3(3-0) S.* The planning, administration, economics and financing of various transportation engineering facilities.

Cribbins

CE 602 Advanced Transportation Design. *Preq.: CE 503. 3(2-3) F.* Design of major traffic and transportation engineering projects.

Horn

CE 603 Airport Planning and Design. *Coreq.: CE 502. 3(2-3) F.* The analysis, planning and design of air transportation facilities.

Cribbins

CE 604 Urban Transportation Planning. *Preq.: CE 502. 3(3-0) S.* Planning and design of urban transportation systems as related to comprehensive urban planning; principles of land use planning, urban thoroughfare planning and regional planning.

Heimbach

CE 605 Traffic Flow Theory. *Preqs.: CE 502, ST 515. 3(3-0) F.* The theoretical techniques used to describe vehicular traffic movement on a street or highway network, including the use of differential-difference equations, hydrodynamic models, probabilistic models, and computer simulation.

Heimbach

CE 614 Plasticity and Limit Analysis. *Preq.: CE 513 or 521. 3(3-0) S. Alt. yrs.* Stress-strain rate relationships and theorems of limit analysis and shakedown in plastic solids. Application to collapse load calculations in arches, rings, plates and axisymmetric shells. Introduction to slip-line field theory of plane plastic flow and to dynamic limit analysis.

Havner

CE 615 Finite Deformation of Materials I. *Preqs.: CE 511 or 513, MA 512. 3(3-0) F. Alt. yrs.* Application of the principles of classical continuum mechanics to the study of large deformation of solid materials. Finite strain geometry and kinematics, work-conjugate stress and stress-rate measures, rotating reference frames, local balance laws and jump conditions. Constitutive equations of nonlinearly elastic and inelastic behavior, general theorems for rate-type boundary value problems, conditions for bifurcation of solution.

Havner

CE 616 Finite Deformation of Materials II. *Preq.: CE 615, 3(3-0) S. Alt. yrs.* Continuation of the study of finite deformation of materials, with emphasis on metal plasticity. Analytical connections between constituent and aggregate behavior in heterogeneous solids. Kinematics of crystals, theories of slip-system hardening, existence of plastic potentials. Physical and mathematical justification for the normality postulate in polycrystalline plasticity. Considerations of experiment, analysis of various mechanical tests at finite strain. Havner

CE 618 Optical Mechanics. *Preq.: CE 311, 3(2-3) S. Alt. yrs.* Concepts of crystal optics applied to continua deformed statically or dynamically by mechanical loading; optical interference and its use as a measuring technique of absolute and relative retardations in various types of interferometers; relative retardation measurements; deformation measurements with diffraction grating; Moire (mechanical) interference measurements. Bingham

CE 619 Experimental Methods in Mechanics. *Preq.: CE 311, 3(2-3) S. Alt. yrs.* A study of specialized experimental techniques utilized in contemporary research in the areas of mechanics. Bingham, Douglas

CE 620 Numerical Methods in Structural Mechanics. *Preqs.: CE 525 and CE 521 or CE 513, 3(3-0) F.* Finite difference and finite element methods in two- and three-dimensional elastic structures, including plates, plane stress and plane strain problems, axisymmetric solids. Analytical basis of approximations: series expansions; energy theorems; virtual work. Matrix decompositions and iteration techniques for digital computer solution. Introduction to nonlinear analysis. Havner

CE 623 Theory of Plates and Shells. *Preq.: CE 513 or CE 521, 3(3-0) F.* Small and large deflection theories of thin plates; membrane analysis of shells. Various methods of analysis are discussed and illustrated by problems of practical interest. Gupta

CE 624 Analysis and Design of Structural Shells and Folded Plates. *Preq.: CE 623, 3(3-0) S. Alt. yrs.* Treatment of roof structures in the form of folded and curved surfaces. Membrane and bending stress analysis of folded plates, shells of revolution, cylindrical and conical shells and free-form systems. Numerical and closed form solutions. Design criteria for concrete and metallic structures. Gupta

CE 625, 626 Advanced Structural Design I, II. *Preqs.: (625) CE 427, CE 525; (626) CE 427; Coreqs.: (626) CE 525, 526, (625) 3(3-0) S. (626) 3(2-3) F. Alt. yrs.* Complete structural design of a variety of projects including comparative study of alternative solutions. Discussions of long span structural systems. Graduate Staff

CE 627 Advanced Analysis and Design of Structures for Dynamic Loads. *Preq.: CE 527, 3(3-0) F. Alt. yrs.* Consideration of the following advanced topics in the analysis and design of structures for dynamic loads: eigenvalue routines and numerical integration techniques; response analysis through the frequency domain; investigation of damping; variational formulation of the equations of motion; analysis and design of continuous systems; approximate methods of analysis; and special topics. Matzen

CE 628 Earthquake Structural Engineering. *Preq.: CE 527, 3(3-0) S.* Study of the effects of earthquakes on structures and of the design of structures to resist earthquake motions; earthquake mechanisms and ground motions; response of structures to earthquake motions; behavior of materials, structural elements and assemblages subjected to earthquakes; principles of earthquake-resistant design practice; soil-structure interactions; and special topics. Gupta, Nau

CE 632 Probabilistic Methods of Structural Engineering. *Preqs.: CE 525 and MA 421, 3(3-0) F. Alt. yrs.* Application of probability theory and stochastic processes to the study of safety of structures. Fundamentals of probability theory and stochastic processes;

probabilistic modelings of structural loadings, material properties and risk. Reliability analysis of structures; reliability-based design criteria. Random vibration of simple structures; safety analysis of structures under dynamic loads. Tung

CE 635 Advanced Theory of Concrete Structures. *Preq.: CE 536. 3(3-0) S.* Inelastic theory of structural concrete members under flexure, axial load, combined flexure and axial compression, shear and torsion. Yield line theory of slabs. Limit analysis of beams and frames of reinforced and prestressed concrete. Zia

CE 641, 642 Advanced Soil Mechanics. *Preq.: Grad. standing. 3(3-0) F.S.* Theories of soil mechanics; failure conditions; mechanical interaction between solids and water, and problems in elasticity and plasticity pertaining to earthwork engineering. Wahls

CE 644 Ground Water Engineering. *Preq.: CE 543 or equivalent. 3(3-0) F.* Ground water problems as related to engineering works, ground water circulation and inventories, subsidence of the ground and its evaluation due to pumping, method of images applied to water circulation of wastes and salt water encroachment in coastal aquifers, transient flow systems in wells and earth dams and embankments. Leakage problems, practical ground water problems and their analysis by computers and electrical models. The legal aspects of ground water conservation and the implied technical and engineering phases. Graduate Staff

CE 646 Dynamics of Soils and Foundations. *Preq.: CE 641. 3(3-0) S. Alt. yrs.* The application of vibration and wave propagation theories to soil media; the review of existing experimental data and empirical procedures for analysis of foundation vibrations, the prediction of soil responses to impulse loads, dynamic properties of soils and methods for their determination, design procedures for foundation subjected to dynamic forces. Rahman, Wahls

CE 665 Construction Equipment Systems. *Preq.: CE 561 or CE 562 or equivalent. 3(3-0) S.* Analysis of earthmoving and other heavy construction processes as systems in order to optimize the selection and employment of construction equipment. Considerations in system design, cost and productivity estimation, operational procedures, safety, and maintenance. Computer applications utilizing analytical and simulation techniques. Graduate Staff

CE 671 Advanced Water Management Systems. *Preq.: CE 484; Coreqs.: CE 571, 573. 4(3-3) F.* The application of systems analysis methods to the design, analysis and management of water and waste systems. Galler

CE 672 Advanced Water and Waste Treatment: Principles and Design. *Preq.: CE 571. 4(3-3) S.* Theory and design of physiochemical processes used to control phosphorus, nitrogen, trace metals and toxic organic substances in water. Galler

CE 673 Industrial Water Supply and Waste Disposal. *Coreq.: CE 571. 3(3-0) F.* Water requirements of industry and the disposal of industries wastes. Graduate Staff

CE 674 Stream Sanitation. *Coreq.: CE 571. 3(3-0) S.* Biological, chemical and hydrological factors that affect stream sanitation and stream use. Graduate Staff

CE 681 Behavior and Analysis of Ocean Structures. *Preq.: CE 527. 3(3-0) S. Alt. yrs.* Introduction to linear and random water waves, analysis of wave forces on small bodies, analysis of wave forces on large bodies, response of offshore structures to waves and earthquake loadings, mooring dynamics. Tung

CE 685 Design of Coastal Facilities. *Preqs.: CE 582 and CE 583. 3(3-0) F.* Types and functions of coastal structures, computation of wave forces on coastal structures, wave uprush, shore protection against waves and storms, planning and design of navigation channels, port development, harbor design, dredging technology, planning and design of offshore platforms, technology of disposal of wastes and heated discharge, consideration of environmental effects of waste disposal. Fisher

CE 687 Numerical Modeling for Nearshore Flow Systems. *Preq.: CE 580 or CE 582 or MEA (CE) 541 or equivalent. 3(3-0) S.* Basic concepts of finite difference methods, methods of characteristics, estuarine and inlet flow computations, implicit methods, surge on the open coast. Introduction to circulation in sounds and bays, modeling of ocean circulation, modeling of sediment movement, mixing processes, water quality modeling. Amein

CE 689 Advanced Topics in Civil Engineering. *3(3-0) F,S.* New or special course on advanced developments in some phase of civil engineering. Specific topics and prerequisites are identified for each section and will vary from term to term. Graduate Staff

CE 698 Advanced Reading in Civil Engineering. *Preq.: Grad. standing. 1-3 F,S.* Directed reading of advanced topics in some phase of civil engineering. Graduate Staff

CE 699 Civil Engineering Research. *Credits Arranged. F,S.* Independent investigation of an advanced civil engineering problem; a report of such an investigation is required as a graduate thesis. Graduate Staff

Computer Science

GRADUATE FACULTY

Professors: W. Chou, D. C. Martin, L. B. Martin, D. F. McAllister, R. J. Plemmons, W. J. Stewart, A. L. Tharp; *Professor Emeritus:* P. E. Lewis; *Associate Professors:* E. W. Davis Jr., R. J. Fornaro, T. L. Honeycutt, H. D. Levin, H. G. Perros, W. E. Robbins, R. D. Rodman, C. D. Savage, K.-C. Tai; *Assistant Professors:* N. M. Bengston, G. Y. Fletcher, E. F. Gehringer, J. Mauney, M. F. M. Stallman, N. F. Williamson Jr.; *Visiting Assistant Professors:* N. A. Blue, M. A. V. Vouk; *Assistant Professor Emeritus:* J. W. Hanson

The Departments of Computer Science and Electrical and Computer Engineering have established a cooperative graduate program with emphasis areas in computer science, digital systems, computer communications and systems software. This is a joint program in which faculty members from both departments are actively involved in teaching, research and advising in the various emphasis areas. Students may pursue master's and Ph.D. degrees in any of the respective areas in the Electrical and Computer Engineering curriculum. Applicants should have a strong background in computer science, engineering, mathematics, statistics or the physical sciences, and a working knowledge of an appropriate higher-level programming language, such as PASCAL or PL/1. Students lacking necessary background will be required to take courses which eliminate the deficiencies in addition to their normal program of study. Research and teaching assistantships are available to qualified applicants. Cooperative master's and Ph.D. programs are also available with the Departments of Mathematics, Statistics and Operations Research.

Computer Science is an active and leading participant in the Computer Studies Program. This master's-level program allows a major emphasis in computer science with non-thesis or thesis options. The program's core requirements emphasize a cooperative effort between computer science and engineering and reflect a narrowing gap between software and hardware.

The Department of Computer Science offers a minor program for graduate students majoring in other fields. A student wishing to minor in computer science should meet the requirements of the Computer Studies Program and should anticipate a research project involving computers. For a candidate for a master's degree, three courses at the 400 level or above are required, and the student is encouraged to take at least one course at the 500 level or above. For a Ph.D. candidate, no specific courses are required, but the student is expected to achieve a high level of proficiency in at least one of these five areas of computer science: foundations, computer systems, numerical processing, programming languages (including compiler design) and information systems. The student's advisory committee, in conjunction with the computer science graduate administrator, will assist in selecting a meaningful sequence of courses.

SELECTED ADVANCED UNDERGRADUATE COURSES

CSC 405 Introduction to Systems Programs. *Preqs.: CSC 202, 256, 311. 3(3-0) F.*

CSC 411 Introduction to Simulation. *Preqs.: Proficiency in a programming language, MA 202, ST 372. 3(3-0) F,S.*

CSC 412 Introduction to Computability, Languages and Automata. *Preq.: CSC 322. 3(3-0) F,S.*

CSC (MA) 416 Introduction to Combinatorics. *Preq.: MA 403 or CSC 322. 3(3-0) Alt. yrs.*

CSC 421 Introduction to Management Information Systems. *Preq.: CSC 311. 3(3-0) F.*

CSC (MA) 427 Introduction to Numerical Analysis I. *Preqs.: MA 301 or MA 312 and programming language proficiency. 3(3-0) F.*

CSC (MA) 428 Introduction to Numerical Analysis II. *Preqs.: MA 405 and programming language proficiency. 3(3-0) F.*

CSC 431 File Organization and Processing. *Preq.: CSC 311. 3(3-0) S.*

CSC 495 Special Topics in Computer Science. *Preq.: CI. 1-6 F,S.*

CSC 499 Undergraduate Research in Computer Science. *Preq.: CI. 1-6 F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

CSC (CSE, ECE) 501 Design of Systems Programs. *3(3-0) F. (See computer studies.)*

CSC 504 Application of Linguistic Techniques to Computer Problems. *Preq.: CSE 502. 3(3-0) S.* Semiotics and programming languages. Comparison of semantic theories. Representation, classification and interpretation of scenes and other multi-dimensional illustrations. Design of a formal language for describing two-dimensional geometric figures, such as flowcharts, chemical structures and logic diagrams. Characterization of programming languages according to the theory of transformational grammar.

CSC (CSE, ECE) 506 Digital Systems Architecture. 3(3-0) F. (See computer studies.)

CSC (CSE, ECE) 510 Software Engineering. 3(3-0) F. (See computer studies.)

CSC (CSE, ECE) 512 Compiler Construction. 3(3-0) S. (See computer studies.)

CSC (CSE, ECE) 518 Computer Graphics. 3(3-0). (See computer studies.)

CSC 532 Artificial Intelligence II. *Preqs.: CSE 511, course in mathematical logic.* 3(3-0) S. A rigorous approach to artificial intelligence emphasizing pattern recognition, theorem proving, game playing, learning and heuristic programming. Students will be assigned computer projects illustrating theoretical concepts introduced in lecture.

CSC 541 Advanced Data Structures. *Preq.: CSC 311 or CSE 453.* 3(3-0) F. Complex and specialized data structures relevant to the design and development of effective and efficient software. Hardware characteristics of storage media. Primary file organizations. Hashing functions and collision resolution techniques. Low level and bit level structures including signatures, superimposed coding, disjoint coding and Bloom filters. Tree and related structures including AV1 trees, B-trees, tries and dynamic hashing techniques.

CSC (CSE, ECE) 542 Database Management. 3(3-0) F. (See computer studies.)

CSC (CSE, ECE, IE, OR) 562 Computer Simulation Techniques. 3(3-0) F. (See computer studies.)

CSC (CSE, ECE) 571 Data Transmission/Communications. 3(3-0) S. (See computer studies.)

CSC (CSE, ECE) 572 Computer Communications. 3(3-0) F. (See computer studies.)

CSC (CSE, ECE) 574 Real Time Computer Systems. 3(3-0) Alt. S. (See computer studies.)

CSC (MA) 582 Numerical Linear Analysis. *Preqs.: MA 405 or equivalent and a knowledge of computer programming.* 3(3-0) F. A mathematical and numerical investigation of direct iterative and semi-iterative methods for the solution of linear systems. Methods for the calculation of eigenvalues and eigenvectors of matrices.

CSC (MA) 583 Numerical Solution of Ordinary Differential Equations. *Preq.: Knowledge to the level of CSC 427.* 3(3-0) S. Numerical methods for initial value problem including predictor-corrector, Runge-Kutta, hybrid and extrapolation methods; stiff systems; shooting methods for two-point boundary value problems; weak, absolute and relative stability results.

CSC (MA) 584 Numerical Solution of Partial Differential Equations—Finite Difference Methods. *Preq.: Knowledge to the level of CSC 427-428.* 3(3-0) F/S. Numerical methods for the solutions of parabolic, elliptic and hyperbolic partial differential equations including stability and convergence results.

CSC (MA, OR) 585 Graph Theory. *Preq.: MA 405.* 3(3-0) F. Basic concepts of graph theory. Trees and forests. Vector spaces associated with a graph. Representation of graphs by binary matrices and list structures. Traversability. Connectivity. Matching and assignment problems. Planar graphs. Colorability. Directed graphs. Applications of graph theory with emphasis on organizing problems in a form suitable for computer solution.

CSC (MA) 587 Numerical Solution of Partial Differential Equations—Finite Element Method. 3(3-0) S. (See mathematics.)

CSC 595 Special Topics. *Preq.: CI. 1-6 F,S.* Topics of current interest in computer science not covered in existing courses.

FOR GRADUATES ONLY

CSC 603 Computational Semantics. *Preqs.: CSE 502, course in mathematical logic. 3(3-0) F* Theoretical prerequisites and computational techniques for the mechanical interpretation of artificial and natural language sentences. Semantics of formal languages. Structural representations of meaning. Semantics of natural languages.

CSC (CSE, ECE) 671 Computer Systems Performance Evaluation. *3(3-0) S. Alt. yrs.* (See computer studies.)

Computer Studies

GRADUATE FACULTY

Professor Wushow Chou, Program Director

Professor D. F. McAllister, Associate Director

Professors: D. P. Agrawal, W. E. Alexander, W. S. Galler, H. J. Gold, D. C. Martin, H. T. Nagle Jr., J. B. O'Neal Jr., R. J. Plemmons, R. S. Sowell, W. J. Stewart, R. E. Stinner, A. L. Tharp; *Adjunct Professor:* J. R. Suttle; *Associate Professors:* E. W. Davis, R. J. Fornaro, T. L. Honeycutt, D. M. Latch, A. A. Nilsson, H. G. Perros, S. A. Rajala, W. E. Robbins, C. D. Savage, J. C. Smith, W. E. Snyder, K. C. Tai, H. J. Trussell; *Assistant Professors:* S. T. Alexander, G. Y. Fletcher, E. F. Gehringer, W. T. Liu, R.-C. Luo, J. Mauney, R. Mehrotra, T. K. Miller III, W. J. Rasdorf, R. D. Rodman, M. F. M. Stallmann, N. F. Williamson

The computer studies program is an interdisciplinary graduate program which is administratively supported by the Departments of Computer Science and Electrical and Computer Engineering, with participation by faculty members primarily from computer science, electrical and computer engineering and operations research.

The program integrates the computer software oriented curriculum of the Department of Computer Science and the computer hardware oriented curriculum from the Department of Electrical and Computer Engineering into a single curriculum. This is in contrast to the traditional arrangement in which the curriculum in an independent computer science department emphasizes software systems and computing theory while the computer engineering curriculum in an electrical and computer engineering department emphasizes hardware systems. The need for the merging of these two types of curricula has been recognized by several other schools through cross-listed courses and joint degree programs. North Carolina State University takes a more positive step by creating a single administrative unit to incorporate the curricula at the graduate level.

Although courses and thesis topics may be chosen in a variety of fields, this program's unique strength lies with the fields combining computer science and

computer engineering. These fields include: computer system architecture and design, computer communications and numerical and optimization techniques.

The field of computer system architecture and design deals with the specification, design and analysis of digital systems, including the study of system architecture, design algorithms and automation, fault tolerant design and simulation. The field of computer communications deals with the methodology of utilizing the state-of-the-art capability of computers and telecommunications for reliable, economic and responsive transfer of digitized information among data transmission equipment, which may be various computers, terminals or telephones with digitized voices. The field of numerical and optimization techniques is concerned with the study of the structure and properties of systems with large numbers of interdependent variables, and with the methodology and application of numerical analysis, dynamical systems theory and systems analysis and mathematical programming of such systems.

For students pursuing a master's degree in computer studies, there are two options: the thesis option, the Master of Science in computer studies and the non-thesis option, the Master of Computer Studies.

Remedial Courses

The immigration modules, CSE 452 through CSE 459, are the remedial courses that are structured primarily for students with a bachelor's degree in one of the quantitative sciences, but with little computer background. However, proficiency in a high-level programming language is assumed. Each module provides in a condensed format the prerequisite knowledge for most first year graduate courses in the program. Each entering student would select, upon advice of the program faculty, those immigration modules necessary to eliminate deficiencies relevant to the program of study. Credit toward satisfying degree requirements for computer studies majors would not be allowed for the immigration modules.

Core Courses

Three core courses, CSE (CSC, ECE) 501, Design of Systems Programs, CSE 505, Design and Analysis of Algorithms and CSE (CSC, ECE) 506, Digital Systems Architecture, are intended to provide a thorough basic knowledge upon which the elective courses may be built. For the non-thesis option, all three are required. For the thesis option, CSE (CSC, ECE) 506 is required and a student may elect either CSE (CSC, ECE) 501 or CSE 505 as the second core course.

Elective Courses

All other courses listed below are elective courses. For classification of the elective courses according to subject areas and for further details, refer to the computer studies brochure.

SELECTED ADVANCED UNDERGRADUATE COURSES

CSE 452 Assembly Language and Basic Computer Organization. *Preqs.: Higher level programming language and CI. 1(1-0) F,S,Sum.*

CSE 453 Data Structures. *Preqs.: Higher level programming language and CI; Coreq.: CSE 452 or equivalent. 1(1-0) F,S,Sum.*

CSE 454 Computer Organization and Logic. *Preqs.: CSE 452 or equivalent and CI. 1(1-0) F,S,Sum.*

CSE 455 Applied Algebraic Structures. *Preqs.: MA 201, higher level programming language and CI. 1(1-0) F.*

CSE 456 Introduction to Computability. *Preqs.: CSE 455 or equivalent and CI. 1(1-0) S.*

CSE 457 Electric Circuits. *Preqs.: MA 202, PY 208, B average in MA and PY. 1(3-0) F.*

CSE 458 Electronic Circuits. *Preq.: CSE 457. 1(3-0) F.*

CSE 459 Linear Systems. *Preqs.: CSE 458, B average in PY. 1(3-0) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

CSE (CSC, ECE) 501 Design of Systems Programs. *Preqs.: CSE 452 and CSE 453. 3(3-0) F,S.* Fundamentals of translators, operating systems and file management systems. Assemblers, macro processors, linkers and loaders. Sequential and concurrent processes, processor and memory management. File structures and file indexing techniques, including hashing, B-trees, AVL trees and tries.

CSE 502 Computational Linguistics. *Preq.: CI. 3(3-0) F.* Natural language processing by computer. Finite-state, context-free, context-sensitive and transformational grammars. Parsing mechanisms including augmented transition networks. Analysis of complex English sentences. Question-answering systems.

CSE 505 Design and Analysis of Algorithms. *Preq.: CSC 311 or CSE 453. 3(3-0) F,S.* Study of techniques for the design of algorithms. Complexity and analysis of algorithms. Study of algorithms for certain classical problems that include sorting, searching, graphs, numerical algorithms and pattern matching.

CSE (CSC, ECE) 506 Digital Systems Architecture. *Preq.: ECE 340 or CSC 312 or CSE 454. 3(3-0) F,S.* Digital systems architecture is the middle ground on which the interests of software, hardware and firmware come together. Among the topics considered are: architectural descriptions, storage systems, I/O systems, stack machines and parallelism. The structure of digital systems implementation will also be considered as it relates to architecture.

CSE (CSC, ECE) 510 Software Engineering. *Preqs.: CSC 311 and CSC 322 or CSE 453 and CSE 455 or equivalent. 3(3-0) F.* The course will introduce the principles and methods for the design, coding and validation of software systems. Among the topics covered are: software design techniques, programming methodology, program testing, proofs of program correctness, software reliability and software management.

CSE 511 Artificial Intelligence. *Preq.: CSC 311. 3(3-0) F.* Definition of heuristic versus algorithmic methods, rationale of heuristic approach, description of cognitive processes. Objectives of work in artificial intelligence, simulation of cognitive behavior. Heuristic programming techniques. Survey of examples from representative application areas. The mind-brain problem and the nature of intelligence. Individual projects to illustrate basic concepts.

CSE (CSC, ECE) 512 Compiler Construction. *Preq.: CSC 311 or CSE 453, 3(3-0) S.* This course is intended to provide a detailed understanding of the techniques used in the design and implementation of compilers. Introduction to formal grammars and relations concerning a grammar. Detailed study of algorithms for lexical scanners, top-down recognizers, bottom-up recognizers for simple precedence grammars, operator precedence grammars, high order precedence grammars and bounded-context grammars. Runtime storage organization for a compiler including symbol tables, internal forms for source programs, semantic routines, error recovery and diagnostics, code generation and optimization and interpreters.

CSE (ECE) 513 Digital Signal Processing. *3(3-0) F.* (See electrical and computer engineering.)

CSE (ECE) 514 Random Processes. *3(3-0) F.* (See electrical and computer engineering.)

CSE (CSC, ECE) 518 Computer Graphics. *Preqs.: MA 405, knowledge of FORTRAN and PASCAL. 3(3-0) F.* Clipping, windowing, transformations, projections, hiddenline and surface removal, smooth shading, shadowing, translucence, reflection, refraction, curve and surface representation.

CSE (ECE) 520 Fundamentals of Logic Systems. *3(3-0) F.* (See electrical and computer engineering.)

CSE (ECE) 521 Digital Computer Technology and Design. *3(3-0) S.* (See electrical and computer engineering.)

CSE 522 Formal Languages and Syntactic Analysis. *Preq.: CSC 412 (CSE 512 recommended). 3(3-0) F.* Detailed study of formal languages and their relation to automata: languages and their representation, grammars, finite automata and regular grammars, context-free grammars and pushdown automata, type 0 grammars and Turing machines, the Halting Problem, context-sensitive grammars and linear bounded automata and operations of languages.

CSE (MA) 529, 530 Numerical Analysis I, II. *3(3-0) F,S.* (See mathematics.)

CSE (ECE) 533 Digital Electronics. *3(3-0) S.* (See electrical and computer engineering.)

CSE (MA) 536 Theory of Sequential Machines. *Preq.: CSC 412 or grad. standing. 3(3-0) F.* Sequential machine identification experiments. Finite-Memory machines. Special classes of machines. Decomposition of sequential machines. Linear sequential machines. Sequential relations of finite-state machines.

CSE (MA) 537 Theory of Computability. *Preq.: CSC 412 or grad. standing. 3(3-0) S.* The concept of effective computability. Turing machines. Primitive recursive functions. The μ -operator. μ -recursive functions. Godel numbering. Equivalence of Turing machines and μ -recursion. Undecidable predicates. Universal Turing machines. Other formulations of the concept of effective computability.

CSE (CSC, ECE) 542 Database Management. *Preq.: CSC 431 or CSE (CSC, ECE) 501. 3(3-0) F.* The course covers the fundamentals of the area of database management. Basic topics include: general architecture for database management systems; current data models such as network, relational, hierarchical; security and integrity; discussion of current implemented systems.

CSE (ECE) 558 Image Processing. *3(3-0) Every yr.* (See electrical and computer engineering.)

CSE (ECE) 559 Pattern Recognition. 3(3-0) S. (See electrical and computer engineering.)

CSE (CSC, ECE, OR, IE) 562 Computer Simulation Techniques. *Preqs.: ST 516 and a scientific programming language.* 3(3-0) F. Basic discrete event simulation methodology: random number generators, simulation designs, validation, analysis of simulation output. Applications to various areas of scientific modeling. Simulation language such as SLAM and GPSS. Computer assignments and projects.

CSE (CSC, ECE) 571 Data Transmission/Communications. *Preqs.: CSE 454 or CSC 312 or ECE 340; CSE 459 or ECE 301.* 3(3-0) S. Deals with the principles and techniques of moving digital data through transmission facilities. To be covered: digital information representation; characteristics of channels; modulation and demodulation (MODEM) techniques; error detection and correction; line control procedure; circuit, message and packet switching; multiplexors and concentrators.

CSE (CSC, ECE) 572 Computer Communications. *Preq.: CSC 312 or ECE 340 or CSE 454; Coreq.: B average in technical subjects.* 3(3-0) F. The purpose of this course is to enable the student to understand the principles, the control and operations and the potential of computer communication systems; to present techniques for topological design and analytic modeling of such systems; and to provide the foundation for more detailed studies and research. The courses are self-contained and focus on practical applications of state-of-art techniques.

CSE (CSC, ECE) 574 Real Time Computer Systems. *Preq.: CSC 405 or CSE (CSC, ECE) 501.* 3(3-0) S. *Alt. yrs.* Hardware and software characteristics of computer systems designed to meet specific response time requirements are studied. Topics include allocation of system resources including processor memory, disk, support I/O devices; synchronous and asynchronous event scheduling; effect of interrupts; static and dynamic priorities; implementation of queues; measurement of performance, especially scheduling and response accuracy.

CSE 591 Special Topics in Computer Studies. *Preqs.: B average in technical subjects and CI.* 3(3-0) F,S. Topics of current interest in computer studies not covered in existing courses.

FOR GRADUATES ONLY

CSE (OR) 605 Large Scale Linear Programming Systems. 3(3-0) S. *Alt. yrs.* (See operations research.)

CSE (ECE) 640 Advanced Logic Systems. 3(3-0) S. (See electrical and computer engineering.)

CSE (ECE) 641 Sequential Machines. 3(3-0) F. (See electrical and computer engineering.)

CSE (ECE) 651 Statistical Communication Theory. 3(3-0) S. (See electrical and computer engineering.)

CSE (ECE) 652 Information Theory. 3(3-0) F. (See electrical and computer engineering.)

CSE (IE,OR) 662 Stochastic Simulation Design and Analysis. *Preqs.: CSE (CSC, ECE, IE, OR) 562 and ST 516.* 3(3-0) S. Advanced topics in stochastic system simulation are covered, including random variate generation, output estimation for stationary and non-stationary models, performance optimization techniques, variance reduction approaches. Students apply these techniques to actual simulations. A paper written on a current research topic is required.

Bengston, Perros, Richards

CSE (CSC, ECE) 671 Computer Systems Performance Evaluation. *Preqs.: CSE 506, MA 421 or CI. 3(3-0) S. Alt. yrs.* Emphasis on the use of analysis and simulation techniques for performance evaluation of computer systems, in particular, communication based and real time systems. To be covered: overview of the performance evaluation techniques; relevant statistics elements; basic queueing models; single component with single jobs; communication based computer systems; real time data processing systems; time sharing and multiprogramming systems; distributed systems.

CSE (MA) 679, 680 Advanced Numerical Analysis I, II. *3(3-0) F,S.* (See mathematics.)

CSE 691 Advanced Topics in Computer Studies. *Preqs.: Grad. standing, CI. 3(3-0) F,S.* Advanced topics of current interest in computer studies not covered by existing courses.

CSE 693 Individual Topics in Computer Studies. *Preqs.: Grad. standing, CI. 1-3 F,S.* An opportunity for an individual graduate student to investigate special topics of interest under the direction of members of the graduate faculty.

CSE 695 Seminar in Computer Studies. *Preqs.: Grad. standing, CI. 1(1-0) F,S.* Seminar discussion of problems of current research interests in computer studies. Seminar speakers consist of advanced graduate students, faculty, and invited speakers.

CSE 699 Computer Studies Research. *Preqs.: Grad. standing, CI. Credits Arranged. F,S.* Individual research by graduate students minoring and majoring in computer studies. Research may be done under the supervision of CSE faculty members meeting the interest and need of the student.

Counselor Education

For a listing of graduate faculty and departmental information, see counselor education under education.

Crop Science

GRADUATE FACULTY

Professor B. E. Caldwell, Head

Professor D. A. Emery, Coordinator of Graduate Programs

Professors: D. S. Chamblee, H. D. Coble, W. K. Collins, F. T. Corbin, W. T. Fike, W. B. Gilbert, M. M. Goodman, J. T. Green Jr., H. D. Gross, W. M. Lewis, R. C. Long, J. P. Mueller, R. P. Patterson, L. L. Phillips, T. J. Sheets, G. A. Sullivan, D. H. Timothy, J. B. Weber, E. A. Wernsman, A. D. Worsham, J. C. Wynne; *Professors (USDA):* J. C. Burns, J. F. Chaplin, G. R. Gwynn, S. C. Huber, J. A. Lee, D. E. Moreland, H. Seltmann, R. F. Wilson; *Adjunct Professor:* L. Thompson Jr.; *Professors Emeriti:* C. T. Blake, C. A. Brim, W. A. Cope, D. U. Gerstel, W. C. Gregory, P. H. Harvey, G. L. Jones, G. K. Middleton, R. P. Moore, D. L. Thompson, J. A. Weybrew; *Associate Professors:* J. R. Anderson Jr., E. J. Dunphy, J. M. DiPaola, R. D. Keys, G. F. Peedin, H. T. Stalker Jr., W. W. Weeks, A. C. York; *Associate Professors (USDA):* J. W. Burton, J. E. Miller; *Assistant*

Professors: D. T. Bowman, A. H. Bruneau, D. A. Danehower, K. A. Langeland, H. M. Linker, J. P. Murphy, S. M. Reed, R. C. Rufty, M. G. Waggoner, G. G. Wilkerson; *Assistant Professors (USDA):* J. M. Anderson, K. O. Burkey, T. E. Carter Jr., T. W. Rufty Jr., P. H. Sisco Jr.

The Department of Crop Science offers instruction leading to the Master of Science and Doctor of Philosophy degrees in the fields of plant breeding, crop production and physiology, forage crops ecology, weed control and plant chemistry. For students who wish general training, the Master of Agriculture is offered.

Excellent facilities for graduate training are available. Many special facilities such as preparation rooms for plant and soil samples, cold storage facilities for plant material, greenhouse space, growth control chambers and access to computer facilities and the plant environment laboratory (Phytotron) are provided if required. Sixteen farms are owned and operated by the State for research investigations. Research farms are located throughout North Carolina and include a variety of soil and climatic conditions needed for experiments in plant breeding, crop management, forage ecology and weed control.

Strong supporting departments increase opportunities for broad and thorough training. Among the departments in which graduate students in crop science work cooperatively or obtain instruction are Biochemistry, Botany, Chemistry, Computer Science, Entomology, Horticultural Science, Genetics, Mathematics, Microbiology, Plant Pathology, Soil Science and Statistics.

In North Carolina, a state which derives 60 to 65 percent of its agricultural income from farm crops, the opportunities for the well-trained agronomist are great. Recipients of advanced degrees in crop science at North Carolina State University are found in positions of leadership in research and education throughout the nation and the world.

SELECTED ADVANCED UNDERGRADUATE COURSES

CS 411 Environmental Aspects of Crop Production. *Preq.: BO 421. 2(2-0) F.*

CS 413 Plant Breeding. *Preq.: GN 411. 2(2-0) S.*

CS 414 Weed Science. *Preq.: CH 220. 4(3-2) F.*

CS (SSC) 462 Soil-Crop Management Systems. *Preqs.: CS 211, CS 414, SSC 341, SSC 342, SSC 352, Sr. standing. 3(2-3) S.*

CS 490 Senior Seminar in Crop Science. *Preq.: Sr. in crop science or related field. 1(1-0) S.*

CS (HS) 492 Topics in Plant Breeding. *1(0-2) S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

CS 511 Tobacco Technology. *Preq.: BO 421 or equivalent. 3(3-0) S.* A study of special problems concerned with the tobacco crop. The latest research problems and findings dealing with this important cash crop will be discussed.
Collins

CS 513 Physiological Aspects of Crop Production. *Preq.: BO 421, 3(3-0) S. Alt. yrs.* Discussion will emphasize pertinent physiological processes associated with crops and crop management such as plant growth, maturation, respiration and photoperiodism. Relationship of the environment to maximum crop yields will be discussed. (Offered S 1986 and alt. years.) Fike

CS (HS) 514 Principles and Methods in Weed Science. *Preq.: CS 414 or equivalent. 3(2-2) S.* Studies of the losses caused by the ecology of weeds, biological control, basic concepts of weed management, herbicide-crop relationships and herbicide development. Introduction to greenhouse and bioassay techniques and field research techniques. Monaco

CS (BO, ENT, PM, PP) 525 Biological Control. *4(3-3) Alt. F.* (See pest management.)

CS (GN, HS) 541 Plant Breeding Methods. *Preqs.: GN 506, ST 511. 3(3-0) F.* An advanced study of methods of plant breeding as related to principles and concepts of inheritance. Murphy, Wehner

CS (GN, HS) 542 Plant Breeding Field Procedures. *Preq.: CS (GN, HS) 541. 2(0-4) Sum.* Laboratory and field study of the application of the various plant breeding techniques and methods used in the improvement of economic plants. (Offered Sum. by arrangement.) Graduate Staff

CS (GN) 545 Origin and Evolution of Cultivated Plants. *Preq.: GN 505 or GN (ZO) 540. 3(3-0) S. Alt. yrs.* Review of progression to modern evolutionary thought; concepts of speciation and classification; origin of variation in plants; theories relating to origins of cultivation and spread of agriculture variation patterns and special attributes of cultigens; interactions of crops and environments; evolution under domestication; modern aspects of evolution as related to breeding. (Offered S 1986 and alt. years.) Stalker

CS (BO, GN, HS) 547 Cell and Tissue Techniques in Plant Breeding. *Preqs.: GN 505B and GN 506B or equivalent. 3(1-4) F. Alt. yrs.* Applications of tissue culture and cytogenetic techniques for plant improvement. Callus and suspension cultures, plant regeneration, *in vitro* selection, haploidy, polyploidy, aneuploidy, wide hybridization and embryo rescue. Practical lab experiences in tissue culture and cytogenetic techniques. Reed, Stalker

CS 591 Special Problems. *Preq.: CI. Credits Arranged. F,S,Sum.* Special problems in various phases of crop science. Problems may be selected or will be assigned. Emphasis will be placed on review of recent and current research. Graduate Staff

FOR GRADUATES ONLY*

CS 611 Metabolism and Crop Productivity. *Preqs.: BCH 451; BO 551 or 552. 3(3-0) S. Alt. yrs.* The course attempts to demonstrate the integration of basic metabolic processes to crop growth and quantitative and qualitative aspects of productivity. Where applicable, special emphasis is given to the interaction of genotype and environment with these processes. (Offered S 1987 and alt. years.) Long

CS (GN, HS) 613 Plant Breeding Theory. *Preqs.: CS (GN, HS) 541, GN 506, ST 512. 3(3-0) S. Alt. yrs.* A study of theoretical bases for plant breeding procedures with special emphasis on the relationship between type and source of genetic variability, mode of reproduction and effectiveness of different selection procedures. The latest experimental approaches to plant breeding will be discussed as well as standard procedures. Graduate Staff

*Students are expected to consult with the instructor before registration.

CS (HS, SSC) 614 Herbicide Behavior in Plants and Soils. *Preqs.: BO 551 and CH 223 or CI 3(3-0) F. Alt. yrs.* The chemical and physiological processes involved in the behavior of herbicides in plants and soils will be examined. Topics to be discussed include absorption, translocation, metabolism and mechanisms of action of herbicides on plants; reactions, movement and degradation of herbicides in the soil; and interactions among herbicides and other pesticides. (Offered F 1987 and alt. years.) Weber

CS 690 Seminar. *Preq.: Grad. standing. 1(1-0) F,S.* A maximum of two credits is allowed toward the master's degree; however, additional credits toward the doctorate are allowed. Scientific articles, progress reports in research and special problems of interest to agronomists are reviewed and discussed. Graduate Staff

CS 699 Research. *Preq.: Grad. standing. Credits Arranged.* A maximum of six credits is allowed toward the master's degree, but no restrictions toward the doctorate. Graduate Staff

Curriculum and Instruction

For a listing of graduate faculty and departmental information, see education.

Design

For a listing of graduate faculty and departmental information, see architecture, landscape architecture, product design.

SELECTED ADVANCED UNDERGRADUATE COURSES

DN 411 Advanced Visual Laboratory. *Preqs.: DF 102, soph. standing. 3(0-6) F,S.*

DN 412 Advanced Photography. *Preq.: DN 312. 3(1-4) S.*

DN 413 Synthetic Drawing. *Preq.: DF 102. 3(2-3) F.*

DN 414 Color and Light Laboratory. *Preq.: DF 102. 3(2-2) F,S.*

DN 418 Ideation II. *Preq.: DN 318. 3(2-2) S.*

DN 419 Multi-Media in Design. *Preq.: DN 212. 3(1-4) S.*

DN 421 Environmental Cognition for Designers. *Preqs.: DN 221/231 or DN 222. 3(3-0) F.*

DN 423 Spatial Cognition for Designers. *Preqs.: DN 221/231 or DN 222. 3(3-0) F.*

DN 430 Site Planning. *Preqs.: DN 221/231 and MEA 120/110 or MEA 101/110 or SSC 205. 3(2-2) F,S.*

DN 432 Environmental Assessment and Design Field Workshop. *Preqs.: DN 221/231 or DN 232. 3(3-0) Sum.*

DN 433 Native Plants in Environmental Design. *Preqs.: DN 221/231 or DN 232, HS 211. 3(2-2) S.*

DN 441 Origins and Development of Contemporary Architecture. *Preqs.: DN 141, 142 for Design students only; others, jr. standing. 3(3-0) F,S.*

DN 443 Landscape History: From the Ice Age to the Present. *Preqs.: DN 141, 142. 3(3-0) F.*

DN 444 History of Landscape Architecture. *Preqs.: DN 141, 142. 3(3-0) F.*

DN 445 Aesthetics and Design. *Preq.: DN 141 or DN 142. 3(3-0) F.*

DN 447 Ideas in American Architecture I: 1865-1893. *Preqs.: Jr. standing. 3(-0) F.*

DN 448 Ideas in American Architecture II: 1893-1918. *Preq.: Jr. standing. 3(3-0) S. Alt. yrs.*

DN 449 Urban Form and Structure. *Preq.: Jr. standing. 3(3-0) F.*

DN 451 Illumination. *Preq.: DN 253. 3(1-4) S.*

DN 452 Climate Control Systems and Design. *Preq.: DN 253. 3(1-4) F.*

DN 453 The Systems Approach to Building. *Preq.: DN 254. 3(3-0) S.*

DN 454 Geometry for Designers. *Preq.: DF 102. 3(2-3) S.*

DN 455 Visual Design Materials and Processes I. *Preq.: DF 102. 3(2-2) S.*

DN 456 Visual Design Materials and Processes II. *Preq.: DF 102. 3(2-2) S.*

DN 462 Predictive Techniques, Predesign Methods, and Programming. *Preq.: DN 261. 3(3-0) S.*

DN 491 Special Seminar in Design. *1-3 F,S.*

DN 492 Special Topics in Design. *1-3 F,S.*

DN 493 Mini-Course in Design. *1-3 F,S.*

DN 494 Internship in Design. *Preqs.: Jr. standing, approval of program director. 3-6 (Max. 6) F,S.*

DN 495 Independent Study in Design. *Preqs.: Jr. standing, approval of program director and core chairman. 1-3 (Max. 6) F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

DN 541 Seminar on Ideas in Design. *Preq.: Grad. standing. 2-3 F,S.* An examination of aesthetics and the relationships of philosophic thought to design.

FOR GRADUATES ONLY

DN 611 Advanced Visual Laboratory. *Preq.: Grad. standing; may be taken for a maximum of 12 credit hours. 2-4 F,S.* Advanced experimental studies in visual phenomena related to design.

DN 698 Design Research and Service Learning Projects. *Preqs.: Grad. standing, consent of program director and graduate committee. 2-6 F,S,Sum.* Problems relevant to design will provide the subjects for graduate study based upon research, service learning projects, on- and off-campus internships and individual investigations will be under the direction of faculty advisors.

Ecology

GRADUATE FACULTY

Professor A. G. Wollum II, Chairman

Professors: S. P. S. Arya, R. C. Axtell, K. R. Barker, U. Blum, J. R. Bradley Jr., S. W. Buol, D. S. Chamblee, A. W. Cooper, B. J. Copeland, P. D. Doerr, G. H. Elkan, D. J. Frederick, L. F. Grand, H. D. Gross, F. E. Guthrie, F. P. Hain, T. O. Perry, E. D. Seneca, D. L. Solomon, R. E. Stinner, H. R. van der Vaart, T. G. Wolcott, A. D. Worsham; *Professor (USDA):* J. C. Burns; *Professor (USDI):* M. T. Huish; *Professor Emeritus:* D. W. Hayne; *Associate Professors:* D. A. Adams, D. M. Benson, K. P. Burnham, J. M. DiPaola, F. L. Gould, B. C. Haning, D. Kamykowski, G. G. Kennedy, R. A. Lancia, J. M. Miller, S. C. Mozley, K. H. Pollock, R. A. Powell, L. A. Real, T. R. Wentworth; *Assistant Professors:* C. Brownie, G. J. House, L. A. Levin

Ecology is the science concerned with the interactions of organisms with each other and with their environment. It is an integrative science through which one gains an understanding of biological and physical interrelationships and predicts the consequences of altering one or several components of an ecosystem.

Students in a number of basic and applied curricula may elect to major in ecology at the master's level leading to an M.S. degree or minor in ecology at the master's and Ph.D. levels. The minor provides an opportunity for a coherent picture of the field of ecology but does not usurp the normal prerogatives of graduate advisory committees in structuring graduate programs.

The ecology minor is an interdepartmental program drawing faculty from the botany, crop science, entomology, forestry, marine, earth and atmospheric sciences, microbiology, plant pathology, soil science, statistics and zoology departments. The program is administered by the Ecology Advisory Committee. Additional information about the program may be obtained by writing to one of the faculty members listed above or to Chairman, Ecology Faculty, P. O. Box 7619, North Carolina State University, Raleigh, North Carolina 27695-7619.

The following courses are recognized as ecological and have been grouped into certain related areas. (For course descriptions, see respective departmental listings.)

General Ecology: BO (ZO) 560 Principles of Ecology; BO 565 Plant Community Ecology; BO (ZO) 660 Advanced Topics in Ecology I; ZO (BO) 661 Advanced Topics in Ecology II.

Population Ecology: ZO 517 Population Ecology; ENT 531 Insect Ecology.

Limnology and Marine Science: ZO 419 Introduction to Limnology; ZO 509 Ecology of Stream Invertebrates; ZO (MEA) 520 Principles of Biological Oceanography; ZO 619 Advanced Limnology.

Behavior: ZO 410 Introduction to Animal Behavior; ZO 501 Ornithology; ZO 691 Topics in Animal Behavior.

Microbial Ecology: MB 501A,B,C Advanced Microbiology I (A-Metabolism; B-Physiology; C-Immunology); MB 503 Microbial Ecology; SSC (MB) 532 Soil Microbiology; PP 611 Advanced Plant Nematology; PP (BO) 625 Advanced Mycology; SSC (MB) 632 Ecology and Functions of Soil Microorganisms.

Terrestrial Ecology: BO 544 Plant Geography; ZO 544 Mammalogy; SSC 551 Soil Morphology, Genesis and Classification; MEA 555 Meteorology of the Biosphere.

Physiological Ecology: ZO (PHY) 513 Comparative Physiology; ZO (FW) 515 Growth and Reproduction of Fishes; BO 561 Physiological Ecology.

Mathematical Biology and Ecology: ZO (FW) 553 Principles of Wildlife Science; BO 570 Quantitative Ecology; BMA (MA, ST) 571, 572 Biomathematics I, II.

Applied Ecology: CS 411 Environmental Aspects of Crop Production; ZO (FW) 420 Fishery Science; ZO 441 Ichthyology; FOR 452 Silvics; FOR 472 Renewable Resource Policy and Management; SSC 472 Forest Soils; HS (CS) 514 Principles and Methods in Weed Science; TOX 515 Environmental Toxicology; ENT 550 Fundamentals of Insect Control; ZO (FW) 554 Wildlife Field Studies; ENT 562 insect Pest Management in Agricultural Crops; ENT (ZO) 582 Medical and Veterinary Entomology; FOR 613 Special Topics in Silviculture; FOR 614 Advanced Topics in Administration of Forest Resources; BO 662 Applied Coastal Ecology.

The requirements for a major in Ecology are:

Master of Science Degree: Six courses including BO (ZO) 560 (or its equivalent), either BO 565, BO (ZO) 660 or ZO(BO) 661, ST 511, ECO 690 and one course from each of two designated areas (population ecology, limnology and marine science, etc.). The latter two courses should not be in the same department as the major professor.

The requirements for a minor in Ecology are:

Master of Science Degree: Three ecological courses, including BO (ZO) 560 (or its equivalent) and either BO 565, BO (ZO) 660 or ZO (BO) 661. The third course should not be in the same department as the major.

Ph.D. Degree: Four ecological courses, including BO (ZO) 560 (or its equivalent) and at least one other course from the general ecology area. One course outside the general ecology area is required. If more than one course is taken from outside the general ecology area, these courses must come from different designated areas (*i.e.*, population ecology, limnology and marine science, etc.). Courses outside the general ecology area should not be from the same department as the major.

Incoming students may apply equivalent courses toward these requirements at the discretion of their graduate committees. Students minoring in ecology, particularly at the Ph.D. level, are encouraged to take courses in mathematics and statistics, at least ST 511 and ST 512.

FOR GRADUATES ONLY

ECO 690 Ecology Seminar. *Preq.: Grad. standing. 1(1-0) F.* Scientific articles, progress reports and special problems of interest to ecologists are reviewed and discussed. Minimum of one seminar presentation required for credit.

ECO 693 Special Problems in Ecology. *Preq.: Grad. standing. 1-6 F,S,Sum.* Investigation of special problems in ecology of particular interest to advanced students under the direction of a faculty member. Directed research in some specialized phase of ecology other than a thesis problem, but designed to provide experience and training in research.

Economics and Business

GRADUATE FACULTY

Professor D. M. Hoover, Head

Associate Professor J. S. Lapp, Associate Head for Economics and Business

Associate Professor M. B. McElroy, Assistant Head and Graduate Administrator

Professor C. J. Messere, Associate Head for Accounting and Business Law

Professor E. W. Erickson, Director for Center for Economic and Business Studies

Professor R. K. Perrin, Associate Head for Agricultural Research and Teaching

Professor C. L. Moore, Associate Head and Extension Specialist, In Charge

Professors: G. A. Carlson, R. L. Clark, A. J. Coutu, R. D. Dahle, L. E. Danielson, J. E. Easley Jr., R. M. Fearn, D. Fisher, A. R. Gallant, D. L. Holley Jr., D. M. Holthausen Jr., D. N. Hyman, L. A. Ihnen, P. R. Johnson, T. Johnson, C. P. Jones, R. A. King, T. E. Nichols Jr., E. C. Pasour Jr., R. J. Peeler, R. A. Schrimper, J. J. Seater, R. E. Sylla, W. D. Toussaint, C. B. Turner; *Extension Professors:* H. L. Liner, R. C. Wells; *Professors Emeriti:* R. C. Brooks, E. W. Jones, B. M. Olsen, C. R. Pugh, J. A. Seagraves, R. L. Simmons, J. G. Sutherland, J. C. Williamson Jr.; *Associate Professors:* S. G. Allen, D. S. Ball, G. A. Benson, E. A. Estes, D. J. Flath, T. J. Grennes, J. D. Hess, C. R. Knoeber, S. E. Margolis, R. B. Palmquist, D. K. Pearce, J. C. Poindexter Jr., R. J. Rossana, D. A. Sumner, M. L. Walden, W. J. Wessels, J. W. Wilson, G. J. Zuckerman; *Associate Professor (USDA):* H. C. Gilliam Jr.; *Associate Professor Emeritus:* C. W. Harrell Jr.; *Assistant Professors:* D. L. Baumer, B. Bublitz, R. N. Collender, M. J. Courchane, J. C. Dutton Jr., N. M. Garren, E. Gerstner, S. A. Hatchell, D. L. Hoag, P. H. Kupiec, J. W. Levedahl, E. A. McDermed, K. Mitchell, C. M. Newmark, J. W. Rockness, R. R. Rucker, C. D. Safley, J. E. Standaert, W. N. Thurman, K. D. Zering

The Department of Economics and Business offers programs of study leading to the Master of Economics, the Master of Arts in economics, the Master of Science in agricultural economics, the Master of Science in management (in conjunction with other departments) and the Ph.D. degree in economics. Emphasis is placed on economic theory and quantitative economic analysis and their application to economic problems. Special seminars and workshops are available to students as a means of pursuing topics of special interest.

Master's programs require a minimum of 30 semester hours. A semester each of intermediate undergraduate micro and macro theory in addition to basic calculus are minimum prerequisites. Except for the Master of Science in management degree, a nine-hour minor (within the 30 hours) is required in some discipline outside the department. No foreign language is required. A six-credit-hour thesis is required for the degrees of Master of Arts in economics and the Master of Science in agricultural economics. A thesis is not required for the other Master's degrees. Course work concentrations may be developed in a number of traditional economics areas (see Ph.D. program description) as well as in management areas. The Master of Science in management requires 36 semester hours, 21 of which are in required core courses. Prerequisites are undergraduate micro and macro theory and a year of calculus. Undergraduate courses in accounting, computer science and statistics are required as important background skills for management students. (See the complete description of this program in this bulletin, listed under management.) A technical option in one of the seven departments offering the degree is a part of the graduate program. A technical option in Economics and Business can be focused on finance, quantitative marketing, labor economics and other areas. A project paper is required at the end of the program.

The Ph.D. program has no specific hour requirements; however, at least six semesters of work beyond the bachelor's degree are required, of which at least two consecutive semesters must be in residence. Candidates take course work and written examinations in economic theory and a minor of their choice. In addition, each student chooses a field of study within the department (*e.g.*, agricultural economics, econometrics, applied macroeconomics, international trade, resource and environmental economics, labor economics and human resources, or managerial economics). A minimum of two semesters of statistics and differential and integral calculus is required of all Ph.D. candidates. There is no foreign language requirement for the Ph.D. Specific programs are designed to meet individual interests and professional objectives.

A well-equipped departmental library, the D. H. Hill Library and library facilities of two nearby major universities are readily available for graduate student use. Graduate students on financial support are provided office space. Computational facilities are available to graduate students for both research and classroom use. The department has a specially trained clerical and programming staff. Students have access to an IBM 370/165 operated by the Triangle Universities Computing Center.

SELECTED ADVANCED UNDERGRADUATE COURSES

ACC 469 Accelerated Survey of Financial and Management Accounting. *Credit may not be received for both ACC 469 and either ACC 261 or 265. Intended for graduate students and advanced undergraduates not in Economics and Business. 3(3-0) F.*

EB 401 Economic Analysis for Nonmajors. *Preq.: EB 201 or 212. 3(3-0) F,S.*

EB 404 Money, Financial Markets, and the Economy. *Preq.: EB 302. 3(3-0) F,S.*

EB 410 Public Finance. *Preq.: EB 301. 3(3-0) F.*

EB 413 Competition, Monopoly and Public Policy. *Preq.: EB 301. 3(3-0) S.*

EB 415 Farm Appraisal and Finance. *Preq.: EB 303 or 310. 3(2-2) F.*

EB 420 Corporation Finance. *Preqs.: EB 201 or 212 and ACC 260 or 265. 3(3-0) F,S.*

EB 422 Investments and Portfolio Management. *Preqs.: EB 350 or ST 311 and EB 420. 3(3-0) F,S.*

EB 430 Agricultural Price Analysis. *Preq.: EB 301. 3(3-0) F.*

EB 431 Labor Economics. *Preq.: EB 301. 3(3-0) F,S.*

EB 435 Urban Economics. *Preq.: EB 301. 3(3-0) F,S.*

EB 436 Environmental Economics. *Preq.: EB 301. 3(3-0) S.*

EB 442 Evolution of Economic Ideas. *Preq.: EB 202 or 212. 3(3-0) F.*

EB 448 International Economics. *Preq.: EB 301. 3(3-0) F,S.*

EB 451 Introduction to Econometrics. *Preqs.: EB 301, 302, 350. 3(3-0) F.*

EB 475 Comparative Economic Systems. *Preq.: EB 201 or 212. 3(3-0) F,S.*

EB (TX) 482 Textile Marketing Management. *Preqs.: EB 301, EB 313, TX 380. 3(2-2) F,S.*

EB (WPS) 485 Management Development Seminar. *Preq.: EB 201 or 212. This course may not be used for credit toward an economics minor for any graduate degree. 3(3-0) S.*

EB 490 Senior Seminar in Economics. *Preqs.: EB 301, 302, 350 and two courses from list of restricted electives. 3(3-0) F,S.*

EB 491 Senior Seminar in Economics. *Preq.: EB 490. 3(3-0) F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ACC 569 Advanced Management Accounting. *Preqs.: ACC 469, EB (ST) 350 and EB 501. 3(3-0) S. The uses of accounting data for management decisions within the firm; applications of formal analytical models including decision theory, statistical analysis of cost behavior and optimization models; management and control of decentralized operations; and the design and evaluation of accounting systems.*

Graduate Staff

EB 501 Price Theory. *Preqs.: MA 113 and EB 301. 3(3-0) F.S.* An intensive analysis of the determination of prices and of market behavior, including demand, cost and production, pricing under competitive conditions and pricing under monopoly and other imperfectly competitive conditions.
Graduate Staff

EB 502 Income and Employment Theory. *Preqs.: EB 301, EB 302, EB (ST) 350, MA 113. 3(3-0) F.S.* Determinants of national income, employment, wages, the interest rate and inflation. Emphasis on the real (as opposed to monetary) determinants of these variables and on the microfoundations of modern macroeconomics. Discussion of monetary and fiscal policy and stochastic elements in income determination.
Graduate Staff

EB (RRA) 503 Economics of Recreation. 3(3-0) F. (See recreation resources administration.)

EB 504 Monetary and Financial Macroeconomics. *Preq.: EB 502. 3(3-0) S.* Financial and monetary determinants of national income and employment and the levels of wages, the interest rate and inflation. Emphasis on the money supply and the banking system. Special topics include banking regulation, budgetary deficits and the dynamics of money stock determination.
D. Fisher, Pearce, Poindexter

EB 512 Law and Economics. *Preq.: EB 301 or EB 401. 3(3-0) F. Alt. yrs.* An economic analysis of the sources and effects of law, including common law, statutory law and regulation. Topics discussed include property rights and contracts, liability rules, crime and punishment, statutory enactment, bureaucratic behavior and institutional reform.
Baumer, Knoeber

EB 513 Research Methods in Marketing. *Preqs.: EB 313, EB 350, EB 501. 3(3-0) S.* A systematic approach to the structure, implementation and analysis of marketing research for decision making. Models of consumer demand and firm behavior analyzed in a marketing context.
Courchane, Gerstner, Levedahl

EB 515 Environmental and Resource Policy. *Preq.: EB 301 or EB 401. 3(3-0) F. Alt. yrs.* Application of price theory and benefit-cost analysis to public decisions related to resources and the environment. Emphasis on evaluation of water supply and recreation investments, water quality management alternatives, public-sector pricing, common property resources and optimum management of forest and energy resources.
Palmquist, Rucker

EB 520 Managerial Finance: Theory and Applications. *Preqs.: EB 420 and EB 301 or 401. 3(3-0) S.* The foundations of finance theory and the empirical evidence available regarding the theory. Applications of basic finance theory, including capital budgeting, markets, valuation, cost of capital, financing alternatives, dividend policy and management of liquid assets. The micro-finance decisions made by a firm, primarily the investment, financing and dividend decisions.
Jones, Kupiec, Mitchell

EB 521 Markets and Trade. *Preq.: EB 301 or 401. 3(3-0) F.* This course emphasizes the space, form and time dimensions of market price and the location and produce combination decisions of firms. Consideration is given to the way in which non-price factors and public policy choices influence firm behavior and the efficiency of marketing systems. Application of these models to agricultural, industrial and public service questions is emphasized, including the relationships between resource availability and the spatial arrangement of economic activity.
Dahle, King

EB 522 Portfolio and Capital Market Theory. *Preqs.: EB 501 and EB 350 or ST 311. 3(3-0) F.* Portfolio theory and its applications, plus capital market theory and the equilibrium pricing of financial assets. The role of securities, utility theory and analysis of secondary markets and their efficiency and the definition and measurement of returns and risks. Valuing securities, including options contracts.
Jones, Kupiec, Mitchell

EB 523 Planning Farm and Area Adjustments. *Preqs.: EB 301, 303 or 401. 3(2-2) S.* The application of economic principles to production problems on typical farms in the state; methods and techniques of economic analysis of the farm business; application of research findings to production decisions; development of area agricultural programs. Neuman

EB 524 Financial Markets. *Preq.: EB 501. 3(3-0) S. Alt. yrs.* The economic characteristics of financial markets and instruments: determination of interest rates; structure of domestic financial markets; flow of funds; nature of financial institutions; nature of financial instruments; and financial market behavior. Jones, Kupiec, Mitchell

EB 525 Managerial Economics. *Preq.: EB 301 or 401. 3(3-0) S. Alt. yrs.* Applications of economic theory to the study of selected business practices in realms of finance, marketing, and management decision making. Specific topics have included: capital budgeting, financial structure, government regulation of industry, pricing strategies, tie-in sales, contractual arrangements between manufacturers and retailers, comparisons of managerial behavior in nonprofit or government enterprise to that in for-profit firms. Flath, Gerstner

EB 532 Economics of Trade Unions. *Preq.: EB 301 or 401. 3(3-0) F. Alt. yrs.* An examination of the growth of the trade union movement in the United States. Primary consideration is given to the impact of unions on the economy through their influence on wages, prices, employment and resource allocation. Other topics include the relationship between the government and unions, the changing compensation mix and the recent growth in public employee unionism. Allen, Clark

EB 533 Economics of World Food and Agricultural Policy. *Preq.: EB 301 or 401. 3(3-0) S.* Economic analysis of the causes and effects of agricultural policies commonly applied in developed, developing and planned economies. Emphasis on economic models of policy analysis. Examination of the impact of commodity, farm input, international trade, consumer and general economic policies on agriculture and the whole economy. Effects of policy on income distribution and economic development. Hoover, Pasour, Sumner

EB 540 Economic Development. *Preq.: EB 301 or 401. 3(3-0) S. Alt. yrs.* An examination of the problems encountered in promoting regional and national economic development. Consideration is given to the structural changes required for raising standards of living. Some basic principles of economics are applied to suggest ways of achieving development goals. Topics include planning strategies, policies and external assistance. Sumner

EB 551 Agricultural Production Economics. *Preqs.: MA 113 and EB 301 or EB 401. 3(3-0) S.* An economic analysis of agricultural production including: production functions, cost functions, programming and decision-making principles. Applications of these principles to farm and regional resources allocation, and to the distribution of income to and within agriculture. Carlson, Hatchett

EB (ST) 561 Intermediate Econometrics. *Preqs.: EB 501 and ST 513. 3(3-0) S.* The formalization of economic hypotheses into testable relationships and the application of appropriate statistical techniques will be emphasized. Major attention will be given to procedures applicable for single equation stochastic models expressing microeconomic and macroeconomic relationships. Statistical considerations that are relevant in working with time series and cross sectional data in economic investigations will be covered. Survey of simultaneous equation models and the available estimation techniques. Schrimper, Thurman

EB 570 Analysis of American Economic History. *Preq.: EB (HI) 371 or grad. standing or PBS status. 3(3-0) S. Alt. yrs.* Stresses the application of economic analysis to the formulation and testing of hypotheses concerning economic growth and development in the historical context. Problems selected for analysis will be drawn primarily from American economic history. Sylla

EB (SOC) 574 The Economics of Population. *Preq.: EB 301 or 401. 3(3-0) S.* A review of population theories from the pre-Malthusian to the contemporary. An introduction to demographic data sources and analysis. Microeconomic models of fertility are intensively treated, and macroeconomic demographic models also are examined. The public policy implications of these models are developed. Discussions include underpopulation, overpopulation, optimum growth rate and incentive schemes. Graduate Staff

EB (TX) 585 Market Research in Textiles. *3(3-0) S.* (See textile materials and management.)

EB 590 Special Economics Topics. *Preq.: CI. Maximum 6. F,S,Sum.* An examination of current vary as problems on a lecture-discussion basis. Course content will changing conditions require new approaches to deal with emerging problems. Graduate Staff

EB 598 Topical Problems in Economics. *Preq.: CI. 1-6. F,S,Sum.* An investigation of topics of particular interest to advanced students under faculty direction on a tutorial basis. Credits and content vary with student needs. Graduate Staff

FOR GRADUATES ONLY

EB 600 Advanced Price Theory. *Preqs.: EB 501, MA 212. 3(3-0) F.* Alternative economic organizations and the role of prices; equilibrium and price determination in a market economy; theory of consumer behavior, derivation of individual demand curves and aggregation to market supply curves; demand for factors of production. Hess, Holthausen

EB 601 Prices, Value and Welfare. *Preq.: EB 600. 3(3-0) S.* The supply of factors of production; alternative nonmonetary theories of capital and interest; productivity; income distribution; determinants of firm size; the nature of market organization; welfare economics topics, including externalities, compensation, social welfare function and consumer surplus. Dutton, Thurman

EB 602 Advanced Income and Employment Theory. *Preq.: EB 502. 3(3-0) F.* An analysis of the forces determining the level of income and employment; a review of some of the theories of economic fluctuations; and a critical examination of a selected macroeconomic system. McElroy, Rossana, Seater

EB 603 History of Economic Thought. *Preqs.: EB 501 and 502 or equivalent. 3(3-0) Sum. Alt. yrs.* A systematic analysis of the development and cumulation of economic thought, designed in part to provide a sharper focus and more adequate perspective for the understanding of contemporary economics. D. Fisher, McElroy

EB 604 Monetary Economics. *Preq.: EB 502 or equivalent. 3(3-0) S.* Consideration of the money market and portfolio management, the cost of capital, effects of monetary phenomena on investment and accumulation of wealth with emphasis throughout on problems arising from uncertainty; general equilibrium theory of money, interest, prices and output. D. Fisher, Lapp, Pearce

EB 606 Industrial Organization and Control. *Preq.: EB 501. 3(3-0) F.* Microeconomic theory is applied to the empirical analysis of public policies that affect the efficiency of resource allocation in the U. S. economy. Special attention is given to the interrelationships between industrial structure, conduct and performance. Flath, Margolis

EB 610 Theory of Public Finance. *Preq.: EB 501. 3(3-0) S.* An application of microeconomic theory and welfare economics to the public sector. Topics include externalities and public policy, the theory of public goods, collective choice, program budgeting and cost-benefit analysis, the theory of taxation and its application to tax policy, public debt, and fiscal federalism. Hyman

EB 615 Environmental and Resource Economics. *Preq.: EB 501. 3(3-0) S. Alt. yrs.* The theoretical tools and empirical techniques necessary for an understanding of resource and environmental economics, developed in both a static and dynamic framework. Discussions of the causes of environmental problems, possible policies and approaches to nonmarket valuation. Analysis of resource use over time using control theory for both renewable and exhaustible resources.
T. Johnson, Palmquist, Rucker

EB 625 Long Range Planning in Business and Industry. *Preq.: EB 501. 3(3-0) F.* Theory and practice of long range planning in business and industry. Case discussions and intensive readings dealing with techniques for identifying opportunities and risks in the environment of the firm, determining corporate strengths and weaknesses, specifying long range strategy. Special attention is given to the roles of management and the internal processes of large organizations as the organizations respond to changes in external conditions.
Holthausen, Newmark

EB 630 Labor Economics. *Preqs.: EB 501 and one of the following: EB (ST) 561, ST 422, ST 512, ST 517. 3(3-0) S.* Application of microeconomic theory and economic methods to labor market behavior in both static and dynamic contexts. Topics include labor demand analysis, labor force participation, hours of work, household production, human capital, distribution of earnings, information and search, and mobility.
Allen, Clark, Fearn

EB 631 Policy and Research Issues in Labor Economics. *Preqs.: EB 501 and one of the following: EB (ST) 561, ST 422, ST 512, ST 517. 3(3-0) F.* Survey of current literature on policy-related issues in labor economics, including trade union behavior, unemployment, macroeconomic aspects of labor market adjustment, discrimination, regulation of wages and benefits and public-sector labor markets. Examples from labor markets in the U. S. and developing countries. Recent research developments in labor economics, topics to vary according to the interests and needs of students.
Clark, Ihnen, Wessels

EB 640 Advanced Economic Development. *Preqs.: EB 501, 502, 540. 3(3-0) F. Alt. yrs.* An analysis of the factors determining the growth of poorer countries and regions of countries. Consideration is given to issues that have arisen in current theoretical and empirical bases for policy decisions. Included in the latter elements are the quantitative foundations for planned and programmed development. Applications of alternative planning methods are evaluated.
King

EB 641 Agricultural Production and Supply. *Preqs.: EB 501 and ST 513. 3(3-0) F.* An advanced study in the logic of, and empirical inquiry into, producer behavior and choice among combinations of factors and kinds and qualities of output; aggregative consequences of individuals' and firms' decisions in terms of product supply and factor demand; factor markets and income distribution; and general interdependency among economic variables.
Carlson, Perrin, Sumner

EB 642 Consumption, Demand and Market Interdependency. *Preqs.: EB 501 and ST 513. 3(3-0) S.* An analysis of the behavior of individual households and of consumers in the aggregate with respect to consumption of agricultural products; the impact of these decisions on demand for agricultural resources, the competition among agricultural regions and for markets; and the interdependence between agriculture and other sectors of the economy.
Schrimer

EB 648 Theory of International Trade. *Preqs.: EB 501, 502. 3(3-0) S.* A consideration of the specialized body of economic theory dealing with the international movement of goods, services, capital and payments. Also, a theoretically oriented consideration of policy.
Dutton, P. Johnson

EB 649 Monetary Aspects of International Trade. *Preq.: EB 502. 3(3-0) F.* Study of the macroeconomic problems of an open economy including the balance of payments adjustment mechanism, alternative exchange rate systems, external effects of monetary and fiscal policy, optimum currency areas and international monetary reform. Grennes

EB 650 Economic Decision Theory. *Preq.: EB 501. 3(3-0) S.* Study of general theories of choice. Structure of decision problems, the role of information; formulation of objectives. Current research problems. Hess, Holthausen

EB (ST) 651 Econometrics. *Preqs.: EB 600, ST 421, ST 502. 3(3-0) F.* The role and uses of statistical inference in economic research; the problem of spanning the gap from an economic model to its statistical counterpart; measurement problems and their solutions arising from the statistical model and the nature of the data; limitations and interpretation of results of economic measurement from statistical techniques. T. Johnson

EB (ST) 652 Topics in Econometrics. *Preq.: EB (ST) 651. 3(3-0) S.* Survey of current literature on estimation and inference in simultaneous stochastic equations systems. Techniques for combining cross section and time series data including covariance, error correlated and error component models. Lag models and inference in dynamic systems. Production functions, productivity measurement and hypotheses about economic growth. Complete and incomplete prior information in regression analysis. Nonlinear estimation in economic models. Gallant, Schrimper

EB 682 Advanced Macroeconomics. *Preq.: EB 602. 3(3-0) F. Alt. yrs.* Advanced study of macroeconomics. Emphasis is on business cycles and behavior of real variables. Topics include: real, incomplete information and disequilibrium theories of the business cycle; rational expectations; contract theory and indexation; investment; and the effects of government expenditure, taxes and debt. Rossana, Seater

EB 684 Monetary Theory. *Preqs.: EB 600, 601, 602, 604. 3(3-0) F. Alt. yrs.* Advanced study of micro- and macro-economic theories of the role of money in the economy. Primary emphasis on money demand and monetary growth models. Specific areas explored include: traditional and recent developments in both asset and transactions theory and rational expectations and optimal policy. Discussion of the empirical record included for most topics. D. Fisher, Pearce

EB 699 Research in Economics. *Preq.: Grad. standing. Credits Arranged.* Individual research in economics under staff supervision and direction. Graduate Staff

Education

GRADUATE FACULTY

Professor C. J. Dolce, Dean

Professor J. B. Kirkland, Dean Emeritus

The following master's degree programs are offered by the School of Education:

- Adult and Community College Education
- Agricultural Education
- Curriculum and Instruction
- Educational Administration and Supervision
- Guidance and Personnel Services
- Industrial Arts Education

Mathematics Education
 Middle Grades Education
 Occupational Education
 Psychology
 Science Education
 Special Education
 Vocational Industrial Education

Students accepted into any of the above education programs may seek either the Master of Science degree or the Master of Education degree; students admitted to the Department of Psychology seek the Master of Science degree. The Master of Science degree is research-oriented and is preparation for further graduate study. The Master of Education is a professional degree which allows for wider latitude in the choice of course work than is allowed by the Master of Science program.

The School of Education also offers certification programs at the intermediate (sixth-year) level in the following fields:

Agricultural Education
 Curriculum and Instruction
 Educational Administration and Supervision
 School Counseling
 Mathematics Education
 Occupational Education
 School Psychology
 Science Education
 Special Education
 Vocational Industrial Education

The following doctoral programs are offered by the School of Education:

Adult and Community College Education	Ed.D.
Curriculum and Instruction	Ed.D.
Educational Administration and Supervision	Ed.D.
Guidance and Personnel Services	Ed.D.
Industrial Arts Education	Ed.D.
Mathematics Education	Ph.D.
Occupational Education*	Ed.D.
Psychology	Ph.D.
Science Education	Ph.D.

All doctoral programs require a minimum of one year of full-time resident study.

Graduate programs are planned by the student and his or her committee in terms of the student's educational and career objectives, experience and previous preparation.

Prior to consideration of an application for admission, the following must have been received: completed application form, an official copy of current (not more

*Students in agricultural education or industrial and technical education would seek the Ed.D. in occupational education.

than three years old) Graduate Record Examination (GRE) scores, official transcripts of all undergraduate and graduate courses taken and at least three completed recommendation forms. In most programs an interview is required. Psychology also requires the GRE Advanced Test and the Miller Analogies Test. Individual programs may have additional requirements for admission. In order to maintain personalized, quality graduate programs, each program can enroll only a limited number of students regardless of the qualifications of the applicants.

The School of Education is housed in Poe Hall, a modern building with up-to-date research and instructional facilities, including:

Curriculum Materials Center—The Curriculum Materials Center, administered by the School of Education, is located in Poe Hall. The center maintains a collection of educational materials with particular emphasis on teaching methods, research, administration and psychology and includes films, filmstrips, slides, audiotapes, video cassettes and simulation games. A special collection of materials about third world countries is also maintained. Audiovisual equipment is available for previewing materials in the center. Microcomputers for teaching and research are a part of this facility. The center acquires textbooks adopted by the State Board of Education for secondary level subjects as well as other selected textbooks and reference materials. The mission of the center is to support programs in the School of Education, and the center's use by campus personnel outside of the School is limited.

Instructional Materials Production Center—Education, instruction and communication require the clear and effective presentation of content. The Instructional Materials Production Center (IMPC) aids this requirement through the design and production of instructional and informational materials in a range of formats. Although resources and personnel of the IMPC predominantly serve faculty, students and projects of the the School of Education, increasing requests for materials from the University and beyond are met as possible on a contract basis.

The IMPC is directed by two instructional designers, faculty members of the School of Education which is unique in having a production facility in which two persons of such training function full time as designers, producers and consultants. Other personnel in the facility serve as teaching assistants, graphic designers or are hired for the special needs of certain projects. Personnel work through the process of instructional design with those persons having a communicational need—faculty members, content specialists or project directors. Careful application of this process is necessary in order to determine what materials and strategies best serve the interrelated considerations of goals, objectives, content, users, audience, cost and available resources and is also necessary if final products are to be as lucid in design as in educational soundness. Formats in which materials are developed include: print, overhead transparencies, graphic imagery, displays and exhibits, signage, photography, slides, slide-tape presentations and in some cases videotape.

Office of Publications—This office prints and publishes instructional materials developed by faculty and students, as well as by public school teachers associated with various School programs.

The Computing Facility is a laboratory and two adjacent classrooms equipped with microcomputers and with terminals and televideos linked to University computing facilities and the Triangle Universities Computing Center (TUCC). The facility is used for faculty research and development, student projects, graphics instruction, in-service teacher training workshops and training.

Other Special Facilities—Poe Hall also houses an extensive variety of shops (metal, wood, ceramic, electrical and photography); a planetarium; counseling and testing centers; several laboratories for the study of behavior; an animal room; and a standardized test library.

Adult and Community College Education

Adult and community college education is a component of both the School of Education and the School of Agriculture and Life Sciences. For a listing of graduate faculty and departmental information, see adult and community college education.

Agricultural Education

GRADUATE FACULTY

Associate Professor L. R. Jewell, *Coordinator*

Professor: J. K. Coster; *Professor Emeritus:* C. C. Scarborough; *Associate Professors Emeriti:* C. D. Bryant, T. R. Miller; *Assistant Professors:* S. F. Everett, B. J. Malpiedi

The agricultural education program offers study leading to the Master of Science and the Master of Education degrees and to the intermediate (sixth-year) certificate. Both master's programs require a minimum of 36 semester hours which reflect the student's background and career expectations and which meet the approval of the student's advisory committee. Graduate programs are designed to meet the needs of individual students for further study and research as well as to prepare them for educational leadership roles in teaching, administration, supervision and research in agricultural education.

SELECTED ADVANCED UNDERGRADUATE COURSE

ED 407 Methods of Teaching Agricultural Mechanics. *Prq.: BAE 201 or 211. 3(3-0) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ED 554 Planning Programs in Agricultural Education. *3(3-0) F,S.*

ED 565 Agricultural Occupations. *3(3-0) F,S.*

ED 566 Occupational Experience in Agriculture. *3(3-0) F,S.*

ED 568 Adult Education in Agriculture. *3(3-0) F,S.*

ED 593 Special Problems in Agricultural Education. *Credits Arranged. F,S.*

FOR GRADUATES ONLY

ED 664 Supervision in Agricultural Education. *3(3-0) F,S.*

ED 693 Advanced Problems in Agricultural Education. *Credits Arranged. F,S.*

ED 694 Seminar in Agricultural Education. *1(1-0) Maximum 2 F.*

Counselor Education

GRADUATE FACULTY

Professor N. A. Sprinthall, Head

Professors Emeriti: W. E. Hopke, L. K. Jones, C. G. Morehead; *Associate Professors:* H. A. Exum, E. R. Gerler, D. C. Locke, J. G. McVay; *Adjunct Associate Professor:* R. F. Anderson; *Associate Professor Emeritus:* B. C. Talley Jr.; *Visiting Assistant Professor:* C. L. Oglesby

The department offers work leading to the Master of Science, Master of Education and Doctor of Education degrees as well as to the sixth-year certificate, with a major in the field of guidance and personnel services. Each of these degrees is designed to prepare individuals for guidance and personnel positions at various levels in elementary and secondary schools, junior and community colleges, trade and technical schools and institutes, institutions of higher education and community agencies. The student may specialize in one of several areas depending upon individual career goals.

It is desirable for an applicant to have had undergraduate or graduate course work in humanities, social and behavioral sciences as well as work experience in a human development context. Students accepted into the department are those who anticipate devoting full- or part-time to guidance and personnel work.

Admission requirements for the department are a minimum of a B average in the junior and senior years of undergraduate work; satisfactory scores on the aptitude section of the Graduate Record Examination or the Miller Analogies Test; three satisfactory letters of recommendation in regard to previous education and employment experiences, personal characteristics and emotional maturity. An interview and work sample are also required for doctoral admission.

For descriptions of the guidance and personnel courses listed below, see education courses.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ED 520 Introduction to Guidance and Counseling. *3(3-0) F,Sum.*

ED 521 Internship in Guidance and Personnel Services. *Credits Arranged. F,S.*

ED 524 Career Counseling and Development. *3(3-0) F,S,Sum.*

ED 530 Theories and Techniques of Counseling. 3(3-0) F,S,Sum.

ED 533 Group Counseling. 3(3-0) S,Sum.

ED 534 Guidance in Elementary and Middle Schools. 3(3-0) F.

ED 535 Student Personnel Work in Higher Education. 3(3-0) F.

ED (PSY) 553 Community Service Agencies. 3(3-0) F.

ED 590 Special Problems in Guidance. *Maximum 6 F,S.*

FOR GRADUATES ONLY

ED 625 Cross Cultural Counseling. 3(3-0) S.

ED 631 Vocational Development Theory. 3(3-0) F.

ED 633 Development and Coordination of School Guidance Programs. 3(3-0) S.

ED 636 Observation and Supervised Field Work. 1-3 F,S.

ED 637 Seminar in Cognitive-Developmental Theory and Practice. 3(3-0) F.

ED 638 Seminar in Cognitive-Developmental Research. 3(3-0) S.

ED 640 Laboratory Experiences in Counseling. 3(3-0) F.

ED 641A Practicum in Counseling. 2-6 S.

ED 666 Supervision of Counseling. 3(1-8) F,S.

Curriculum and Instruction

GRADUATE FACULTY

Professor P. H. Martorella, Head

Professor: B. M. Parramore; Associate Professors: J. F. Arnold, C. L. Crossland, B. J. Fox, C. W. Harper Jr.; Visiting Associate Professor: L. Thies-Sprinthall; Associate Professor Emeritus: P. J. Rust; Assistant Professors: H. C. Griffin, R. J. Pritchard, E. S. Vasu; Visiting Assistant Professor: M. E. Mayesky Holroyd; Adjunct Assistant Professors: L. C. Aubrecht, D. D. Copeland, M. D. Durfee, N. D. LeVere, M. D. Siedow; Assistant Professor Emeritus: K. A. McCutchen

The department offers work leading to the Master of Education, Master of Science and Doctor of Education degrees. A sixth-year program leading to certification is also available. Those completing the master's program may qualify for a graduate teaching certificate in an area of specialization or for a supervisor's certificate.

Students may specialize in one of several areas:

- Curriculum development
- English and language arts education
- Instructional design and technology
- Middle years education
- Reading education
- Social studies education
- Special education
- Supervision

Graduate programs are designed for those who plan to qualify as supervisors, instructional specialists, curriculum developers, teacher educators and consultants at preschool through university levels. Graduates may enter positions in public schools, service agencies, higher education institutions and industries.

In addition to meeting the requirements of the Graduate School, applicants must provide evidence of satisfactory scores on the Graduate Record Examination and/or Miller Analogies Test; submit a written statement of professional goals; and arrange for a departmental interview upon request.

SELECTED ADVANCED UNDERGRADUATE COURSE

ED 483 An Introduction to Instructional Media. *Preq.: Advanced undergrad. standing.* 3(3-0) F,S,Sum.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ED 501 Computer Applications in Instruction. 3(3-0) F,S.

ED 502 The School Curriculum. 3(3-0) F.

ED 506 Education of Exceptional Children. 3(3-0) F.

ED 507 Foundations of Middle Years Education. 3(3-0) F.

ED 508 Education of Severely Handicapped. 3(3-0) F.

ED 509 Methods and Materials Teaching Retarded Children. 3(3-0) S.

ED 513 Introduction to Issues and Techniques in Visual Impairments. 3(3-0) F.

ED 519 Early Childhood Education. 3(1-4) S,Sum.

ED 523 Orientation and Mobility of the Visually Impaired. 3(3-0) F.

ED (PSY) 531 Mental Retardation. 3(3-0) F.

ED 536 Structure and Function of the Eye and Use of Low Vision. 3(3-0) F.

ED 540 Career/Vocational Education for the Handicapped. 3(3-0) S.

ED 542 Contemporary Approaches in the Teaching of Social Studies. 3(3-0) S.

ED 544 The Teaching of Composition. 3(3-0) S.

- ED 545 **Developmental Reading Instruction.** *3(3-0) F.*
- ED 546 **Principles and Practices of Secondary School Reading Instruction.** *3(3-0) F,S.*
- ED 547 **Analysis of Reading Abilities.** *3(3-0) F.*
- ED 548 **Development of Microcomputer Software for Instruction.** *3(3-1) F.*
- ED 549 **Reading for the Middle Years.** *3(3-0) S. Alt. yrs.*
- ED 551 **Principles and Practices of Supervision.** *3(3-0) S.*
- ED 556 **Learning Disabilities.** *3(3-0) F.*
- ED 557 **Methods and Materials in Learning Disabilities.** *3(3-0) S.*
- ED 558 **Resource Teaching in Special Education.** *3(3-0) F.*
- ED 560 **Teaching Through the Arts.** *3(3-0) S.*
- ED 561 **Educational Diagnosis and Prescription for Exceptional Children.** *3(3-0) S.*
- ED 562 **Communication Disorders in the Classroom.** *3(3-0) S. Alt. yrs.*
- ED 563 **Effective Teaching.** *3(3-0) F,S,Sum.*
- ED 564 **Classroom Management in Special Education.** *3(3-0) S.*
- ED 571 **Introduction to the Gifted Individual.** *3(3-0) F.*
- ED 572 **Methods for Teaching the Gifted.** *3(3-0) S.*
- ED 573 **Behavior Disorders.** *3(3-0) F.*
- ED 574 **Methods and Materials Behavior Disorders.** *3(3-0) S.*
- ED 576 **Teaching/Learning Approaches for Emerging Adolescents.** *3(3-0) S.*
- ED 582 **Teaching Braille and Communication Skills.** *3(3-0) S.*
- ED 583 **Design and Evaluation of Instructional Materials.** *3(3-0) S.*
- ED 586 **Methods and Materials in Visual Impairments.** *3(3-0) S.*
- ED 598 **Special Problems in Curriculum and Instruction.** *1-6 F,S,Sum.*

FOR GRADUATES ONLY

- ED 602 **Curriculum Theory and Development.** *3(3-0) S.*
- ED 606 **Remediation of Reading Disabilities.** *3(3-0) S.*
- ED 641B **Practicum in Reading.** *1-6 S.*
- ED 641C **Practicum in Special Education.** *1-6 F,S.*
- ED 641G **Practicum in Middle Years Education.** *3-6 F,S.*

ED 641K Practicum in Supervision. 3-6 F,S.

ED 648 Theory and Process in Reading and Language Arts. 3(3-0) F. Alt. yrs.

ED 665 Supervising Student Teachers. 3(3-0) F,S.

ED 687 Seminar in Curriculum and Instruction. 1-3 F. Alt. yrs.

Educational Administration and Supervision

GRADUATE FACULTY

Associate Professor B. G. Beezer, *Acting Head*

Professor: C. J. Dolce; *Associate Professors:* W. B. Harvey, J. C. Marshall, R. C. Serow; *Adjunct Associate Professor:* W. J. Brown; *Assistant Professors:* E. MacPhail-Wilcox; *Lecturer:* R. T. Williams

The graduate programs in educational administration and supervision have a multidisciplinary emphasis which includes courses in economics, politics, psychology and sociology as well as in professional education. Within the constraints required for certification, programs are planned individually, based on an analysis of the student's career objectives and competencies. In addition to formal courses, planned non-credit experiences are offered to enhance the student's professional development.

The master's degree programs (M.S., M.Ed.), which require a minimum of 36 credit hours, are designed to prepare individuals for entry-level administrative positions in public schools, colleges and other educational agencies. One semester of full-time residency is required in the Master of Science degree program. The master's program must be completed within four years from the semester of admission. An intermediate (sixth-year certificate) program, which leads to the second level of certification, is also available for public school personnel.

The doctoral degree program (Ed.D.), which requires extensive work in research and clinical practice (internship), is designed to prepare individuals for advanced administrative and supervisory positions in public schools, education service agencies, education policy positions and higher education. One academic year of full-time residency is required. The doctoral program must be completed within six years from the semester of admission.

In addition to admission requirements of the Graduate School, there are two additional requirements: a recent Graduate Record Examination score (both verbal and quantitative), and a narrative statement which describes in detail the applicant's career objectives and specific objectives for enrolling in the graduate program.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ED 514 Formative Ideas in American Education. 3(3-0) F.

ED 515 Education and Social Diversity. 3(3-0) S. Alt. yrs.

ED 517 **Administrative Technology in Education.** 3(3-0) S. Alt. yrs.

ED 518 **Introduction to Education Law.** 3(3-0) S.

ED 532 **Introduction to Educational Inquiry.** 3(3-0) F,S,Sum.

ED 541B **Practicum in Education Administration.** 1-6 F,S.

ED 550 **Principles of Educational Administration.** 3(3-0) F,S.

ED 569 **The Principalship.** 3(3-0) S. Alt. yrs.

ED 578 **Law and Higher Education.** 3(3-0) S. Alt. yrs.

ED 580 **Evaluation Theory and Practice in Education.** 3(3-0) F.

ED 589 **Central Office Administration.** 3(3-0) F. Alt. yrs.

FOR GRADUATES ONLY

ED 614 **Contemporary Educational Thought.** 3(3-0) Alt. S.

ED 616 **History of Higher Education in the United States.** 3(3-0) F. Alt. yrs.

ED 618 **School Law for the Administrator.** 3(3-0) S. Alt. yrs.

ED 620 **Cases in Educational Administration.** 3(3-0) S. Alt. yrs.

ED 632 **Applied Research Methods in Education.** 3(1-4) S.

ED 697 **Problems of Research Design in Education.** 1-3 S. Alt. yrs.

Industrial and Technical Education

GRADUATE FACULTY

Associate Professor J. R. Clary, Acting Coordinator

Professors Emeriti: D. M. Hanson, J. T. Nerden; *Associate Professor:* E. I. Farmer;
Associate Professor Emeritus: F. S. Smith; *Assistant Professor:* N. A. Foell;
Assistant Professor Emeritus: T. C. Shore Jr.

The program in industrial and technical education provides graduate work leading to the degrees of Master of Science and Master of Education and to the intermediate (sixth-year) certificate in vocational industrial education. The rapid development of industrial and technical education in North Carolina and throughout the nation provides opportunities for teachers, supervisors and administrators who have earned advanced degrees.

The facilities at the University allow supporting courses at the graduate level in the related fields of computer science, economics and business, engineering, guidance and personnel services, mathematics, psychology, sociology and statistics. The prerequisite for graduate work in the programs in industrial and technical education is a proficiency in the undergraduate courses required for the bachelor's degree in industrial or technical education or a substantial equivalent.

SELECTED ADVANCED UNDERGRADUATE COURSES

ED 421 Principles and Practices in Industrial Cooperative Training. *Preqs.: ED 327, 344, 305. 3(3-0) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES*

ED 525 Advanced Trade Analysis and Course Construction. *3(3-0) F.*

ED 591 Special Problems in Industrial Education. *Maximum 6. F,S.*

FOR GRADUATES ONLY

ED 608 Supervision of Occupational Education. *3(3-0) F.*

ED 609 Planning and Organizing Industrial and Technical Education P Programs. *3(3-0) F.*

ED 691 Seminar in Industrial Education. *1(1-0) S.*

Industrial Arts Education

GRADUATE FACULTY

Associate Professor R. E. Peterson, *Coordinator*

Professor Emeritus: D. W. Olson; *Associate Professor:* R. E. Wenig; *Associate Professors Emeriti:* W. L. Cox Jr., T. B. Young; *Assistant Professor:* V. W. DeLuca

The industrial arts education program offers graduate work leading to the degrees of Master of Science, Master of Education and Doctor of Education. Graduate programs are designed for teachers who wish to develop their instructional competencies and for those who wish to be supervisors and administrators of industrial arts programs.

SELECTED ADVANCED UNDERGRADUATE COURSE

IA 480 Modern Industries. *Preq.: Jr. standing. 3(3-0) S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

IA 510 Design for Industrial Arts Teachers. *Preqs.: Six hours of drawing, IA 231 or equivalent. 3(2-2) Sum.* A study of new developments in the field of design with emphasis on the relationship of material and form in the selection and designing of industrial arts projects.
Graduate Staff

ED 552 Industrial Arts in the Elementary School. *3(3-0) Sum.*

*For other courses, see occupational education.

IA 560 New Developments in Industrial Arts Education. *Preqs.: Twelve hours of education and teaching experience. 3(3-0) F,S,Sum.* This course is a study of the new developments in industrial arts education. It is designed to assist teachers and administrators in developing new concepts and new content based on the changes in technology. Graduate Staff

IA 582 Visual Communications in Industrial Arts Education. *Preq.: Advanced standing in IAE or CI. 3(2-2) S. Alt. yrs.* Designed to enable teachers to understand key technical developments in the area of visual communications. Emphasis is upon developing pilot testing and evaluating a sequence of laboratory activities for school environment Peterson

ED 588 Advanced Teaching Methods in Industrial Arts Education. *3(2-2) F,Sum.*

IA 590 Laboratory Problems in Industrial Arts. *Preqs.: Sr. standing, CI. Maximum 6. F,S,Sum.* Courses based on individual problems and designed to give advanced majors in industrial arts education the opportunity to broaden or intensify their knowledge and abilities through investigation and research in the various fields of industrial arts, such as metals, plastics, ceramics or electricity-electronics. Graduate Staff

IA 592 Special Problems in Industrial Arts. *Preq.: One term of student teaching or equivalent. Maximum 6. F,S,Sum.* The purpose of this course is to broaden the subject matter experience in the areas of industrial arts. Problems involving curriculum, investigation or research in one or more industrial arts areas will be required. Graduate Staff

IA 595 Industrial Arts Workshop. *Preq.: One or more years of teaching experience. 3(3-0) Sum.* A course for experienced teachers, administrators and supervisors of industrial arts. The primary purpose will be to develop sound principles and practices for initiating, conducting and evaluating programs in this field. Enrollees will pool their knowledge and practical experiences and will do intensive research work on individual and group problems. Graduate Staff

FOR GRADUATES ONLY

ED 630 Philosophy of Industrial Arts. *2(2-0) F,S.*

ED 635 Administration and Supervision of Industrial Arts. *2(2-0) F,S.*

IA 645 Technology and Industrial Arts. *Preqs.: IA 560, ED 630. 3(3-0) F,S.* Technology: its nature, origins, advance. Impact of technological advance on man and culture. Technology as the material culture. Changing concepts of work, skill, occupations, discretionary time. Technology and its relation to industrial arts education. Graduate Staff

ED 692 Seminar in Industrial Arts Education. *1(1-0) F,S.*

Mathematics and Science Education

GRADUATE FACULTY

Professor A. C. Howe, Head

Professors: N. D. Anderson, L. M. Clark, J. R. Kolb; Professor Emeritus: H. E. Speece; Associate Professors: W. M. Waters Jr., L. W. Watson, J. H. Wheatley; Associate Professor Emeritus: H. A. Shannon; Assistant Professor: L. V. Stiff

The Department of Mathematics and Science Education offers graduate work leading to the degrees of Master of Science, Master of Education and Doctor of Philosophy with majors in mathematics education or in science education and intermediate level certification in both fields. Each student's program is individually planned by a graduate committee and will reflect the student's undergraduate and graduate preparation, teaching experience and future professional plans. Students take courses in both professional education and in their teaching specialties. Areas of specialization include mathematics, biological sciences, earth science, chemistry and physics.

Doctoral students are required to have a reading knowledge of one modern foreign language. Additional communication skills may be required by the advisory committee. Independent reading and participation in seminars are an indispensable part of the doctoral program. The heart of the program is the dissertation, a document based on original research that makes a significant contribution to science education or mathematics education.

Applicants must meet the admissions requirements of the Graduate School and have departmental approval.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ED 511 Implications of Mathematical Content, Structure, and Processes for the Teaching of Mathematics in the Elementary School. 3(3-0) S,Sum. Alt. yrs.

ED 512 Teaching Mathematics in Elementary and Junior High School. 3(3-0) S,Sum. Alt. yrs.

ED 526 Teaching in College. 3(3-0) Sum.

ED 570 Foundations of Mathematics Education. 3(3-0) S,Sum. Alt. yrs.

ED 575 Foundations of Science Education. 3(3-0) S,Sum., Alt. yrs.

ED 577 Improving Classroom Instruction in Science. 3(3-0) F,S.

ED 592 Special Problems in Mathematics Teaching. 1-3 F,S,Sum.

ED 594 Special Problems in Science Teaching. 1-6 F,S,Sum.

FOR GRADUATES ONLY

ED 603 Teaching Mathematics and Science in Higher Education. 3(3-0) F.

ED 604 Curriculum Development and Evaluation in Science and Mathematics. 3(3-0) S.

ED 605 Education and Supervision of Teachers of Mathematics and Science. 3(3-0) S.

ED 641D Practicum in Science and Mathematics Education. 1-6 F,S.

ED 690 Seminar in Mathematics Education. 2(2-0) F,S.

ED 695 Seminar in Science Education. 2(2-0) F,S.

Occupational Education

GRADUATE FACULTY

Associate Professor J. R. Clary, Head

Associate Professor: L. R. Jewell, Graduate Administrator

Assistant Professor: J. A. Davis, Coordinator of Health Occupations

Professor: J. K. Coster; Professors Emeriti: D. M. Hanson, J. T. Nerden, C. C. Scarborough; Associate Professors: L. S. Dillon, E. I. Farmer, R. E. Peterson, R. E. Wenig; Associate Professors Emeriti: C. B. Bryant, W. L. Cox Jr., T. R. Miller, F. S. Smith, T. B. Young; Assistant Professors: J. L. Crow, V. W. DeLuca, S. F. Everett, N. A. Foell, B. J. Malpiedi, W. J. Vander Wall; Visiting Assistant Professor: M. M. Turnbull; Adjunct Assistant Professors: C. E. Belcher, B. M. Patterson; Assistant Professor Emeritus: T. C. Shore Jr.

The Department of Occupational Education includes programs leading to advanced degrees in the program areas of agricultural education, health occupations education, industrial and technical education, and industrial arts education. For descriptions of the advanced degree programs in these areas, see earlier sections in education. In addition, the department offers advanced degree programs in occupational education and courses leading to certification in the teaching of middle grades occupational exploration.

This section of the catalog describes the advanced programs in occupational education *per se*; that is, programs in which the major is occupational education. The department offers leadership development programs in occupational education for the Master of Education and Master of Science degrees, the Intermediate (Sixth-Year) Program, and Doctor of Education degree.

The master's programs are designed to prepare persons for entry-level administrative and supervisory positions in occupational education. However, students may prepare for other careers, such as master teachers of career exploration programs.

The master's programs require a minimum of 36 semester hours of graduate work, including 27 hours in the major. Additional hours will be specified by the student's advisory committee for those who do not have a baccalaureate degree in an occupational education field. Students who elect the Master of Science substitute the thesis for part of the course load.

The Intermediate (Sixth-Year) Program requires a minimum of 60 semester hours of graduate work, including 48 hours in the major.

The primary purpose of the doctoral program is to prepare persons for advanced positions in occupational education. Students may elect to prepare for such positions as administrator, research specialist, curriculum development specialist or teacher education in occupational education. A minimum number of 90 semester graduate work beyond the baccalaureate degree is specified for the doctoral

program. Emphasis is placed on developing competencies, and students may be advised to supplement their course work.

Applicants to the graduate level programs must take the Graduate Record Examination or the Miller Analogies Test and submit a resume of work experience with a statement of career goals. Application processes must be completed within six months of the date the application is received.

All doctoral programs require a minimum of one year of full-time resident status devoted to the program and programs must be completed within six years from the beginning of the semester in which the student is initially enrolled in the doctoral classification. Other department policies should be requested from the graduate administrator.

SELECTED ADVANCED UNDERGRADUATE COURSE

ED 457 Organization and Management of Youth Club Activities. *Preq.: Jr. standing.* 3(3-0) F,S.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ED 516 Community Occupational Surveys. 2(2-0) S.

ED 522 Career Exploration. 3(3-0) F,S,Sum.

ED 527 Philosophy of Occupational Education. 3(3-0) F,S.

ED 528 Cooperative Occupational Education. 3(3-0) F,S.

ED 529 Curriculum Materials Development. 3(3-0) F,S.

ED 541A Practicum in Occupational Education. 1-6 F,S.

FOR GRADUATES ONLY

ED 608 Supervision of Occupational Education. 3(3-0) F. *Alt. yrs.*

ED 609 Planning and Organizing Industrial and Technical Education Programs. 3(3-0) F. *Alt. yrs.*

ED 610 Administration of Occupational Education. 3(3-0) S. *Alt. yrs.*

ED 611 Laws, Regulations and Policies Affecting Occupational Education. 3(3-0) S.

ED 612 Finance, Accounting, and Management of Occupational Education Programs. 3(3-0) S. *Alt. yrs.*

ED 688 Research Application in Occupational Education. 3(3-0) F,S.

ED 689 Evaluation in Occupational Education. 3(3-0) F,S.

Health Occupations Education Program Area—The master's degree level program track in health occupations teacher education has been established in response to an increasing need for accountability in professional education and for qualified educators in the health fields. The program is designed to provide a broad

comprehension of the health care delivery system and the education of future providers of service and to develop competency in curriculum and instruction planning and implementation. Students desiring to move into administrative and supervisory roles are encouraged to design a plan of study consistent with their personal goals. Students must hold credentials in one of the health disciplines and have knowledge of the health care system.

Students will be encouraged to participate in the interinstitutional cooperative program that exists between the graduate school of North Carolina State University, Duke University and the University of North Carolina at Chapel Hill which makes available a vast array of offerings in the health field from which to select courses.

SELECTED ADVANCED UNDERGRADUATE COURSE

ED 433 Health Occupations Specialty Practicum. *Preq.: Current credential in a recognized health discipline. 6 Arranged. F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ED 555 Issues and Trends in Education for the Allied Health Professions. *3(3-0) Alt. yrs.*

ED 581 Curriculum and Instruction in the Allied Health Professions. *3(3-0) Alt. yrs.*

ED 584 Health Care Delivery Systems and Environments. *3(3-0) Alt. yrs.*

FOR GRADUATES ONLY

ED 615 Special Topics in Health Occupations Education. *3-5 F,S,Sum.*

ED 641J Practicum in Health Occupations. *3(3-0) Alt. yrs.*

Psychology

For a listing of departmental faculty and courses, see psychology.

Education Courses

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ED 500 Community College and Two-year Postsecondary Education. *Preq.: Grad. standing or PBS status. 3(3-0) F,S.* Comprehensive community colleges and technical institutes and the state systems of which they are a part: underlying concepts, educational needs they are designed to serve, role in meeting these needs, historical development, issues in the establishment and operation of state systems and individual institutions, unresolved issues and emerging trends. Graduate Staff

ED 501 Computer Applications in Instruction. *Preq.: Six hrs. ED or PSY or CI. 3(3-0) F,S.* Emphasis is on the use and evaluation of existing educational software and research findings with respect to the uses of computers in instruction. Martorella, Vasu

ED 502 The School Curriculum. *Preq.: 12 semester hours ED and PSY or CI. 3(3-0) F.* A study of the origin, development, and current status of the elementary and secondary school curriculum and an evaluation of the trends and issues likely to influence the curriculum in the future. Parramore

ED 503 The Programming Process in Adult and Community College Education. *Preqs.: ED 501, CI. 3(3-0) F.S.* The principles and processes involved in programming, including basic theories and concepts supporting the programming process. Attention will be given to the general framework in which programming is done, the organization needed and the program roles of both professional and lay leaders. Graduate Staff

ED 504 Principles and Practices of Introduction to Vocations. *Preq.: 12 hours ED or CI. 3(3-0) F.S.Sum.* This course is designed for teachers in the public schools of North Carolina who teach "Introduction to Vocations." The course emphasizes the place of the introduction to vocations program in the overall school curriculum, special methods of instruction, use of teaching aids and use of student evaluation instruments. An overview is also presented in the areas of community organization, job markets, group procedures, occupational and educational information and the changing occupational structure in our society. Clary, Dillon

ED 505 Public Area Schools. *Preq.: Grad. standing or PBS status. 3(3-0) F.* Junior and community colleges, technical institutes, vocational schools and branches of universities: their development, status and prospects, policy and policy-making, clientele, purposes, evaluation programs, personnel, organization administration, financing, facilities, research and development functions. Graduate Staff

ED 506 Education of Exceptional Children. *Preq.: 9 hours of ED or PSY. 3(3-0) F.S.Sum.* An introduction to the field of Special Education. The course focuses on the historical overview, definitions and terminology in the basic areas of exceptionality; etiological factors in exceptionality; developmental and learning characteristics of each area of exceptionality; and educational settings and strategies employed in special education. A review is given of current educational laws and policies affecting special education. Graduate Staff

ED 507 Foundations of Middle Years Education. *Preq.: 6 hours of ED and PSY. 3(3-0) F.S.* Five major aspects of middle years education are examined: (a) the history and purposes of middle/junior high school, (b) pre- and early adolescent needs, interests and abilities, (c) curriculum design and content, (d) teaching methods and (e) school organization. Both theoretical understandings and effective classroom strategies will be emphasized. Arnold

ED 508 Education of Severely Handicapped. *Preq.: ED 531 or ED 574 or CI. 3(3-0) F.* A study of severe and profound mental retardation and autism, including assessment procedures, educational and social/vocational programs, instructional strategies and evaluation. Legal and ethical issues involved in working with the severely handicapped are examined. Graduate Staff

ED 509 Methods and Materials—Teaching Retarded Children. *Preqs.: ED 506 and ED 531 or CI. 3(3-0) S.* A study of the methods and materials related to teaching mentally retarded school age children. Course will include the study of the learning and behavioral characteristics and educational programs for the mentally retarded in the areas of motor, communications, social, academic and vocational development. Crossland

ED 510 Adult Education: History, Philosophy, Contemporary Nature. *Preqs.: Advanced undergrad., CI. 3(3-0) F.S.* A study of the historical and philosophical foundations of adult education from ancient times to the present, giving attention to key figures, issues, institutions, movements and programs, including consideration of the relationship between adult education's historical development and prevailing intellectual, social, economic and political conditions. Consideration of adult education's contemporary nature, present-day schools of thought on its objectives and trends. Carter

ED 511 Implications of Mathematical Content, Structure, and Processes for the Teaching of Mathematics in the Elementary School. *Preq.: Bachelor's degree in elementary education or CI. 3(3-0) S.Sum. Alt. yrs.* Designed for teachers and supervisors of mathematics in the elementary or middle school. Special emphasis on implications of mathematical content, structure, and processes in teaching arithmetic and geometry.

Waters, Watson

ED 512 Teaching Mathematics in Elementary and Junior High School. *Preq.: ED 471 or equivalent. 3(3-0) S.Sum. Alt. yrs.* Comprehensive study of teaching mathematics in elementary and junior high schools. Major emphasis on building skills in teaching arithmetic, elementary algebra and intuitive geometry. Thorough search of the literature relative to the mathematics curricula will be conducted, designing and sequencing of learning activities, teaching mathematical concepts and relationships, building skill in computation, reading mathematics, problem solving and measurement will be covered.

Kolb, Watson

ED 513 Introduction to Issues and Techniques in Visual Impairments. *Preq.: ED 506. 3(3-0) F.* Addresses historical developments, trends, issues and basic skill techniques for the visually impaired. Includes societal perceptions, societal integration, effects of a visual impairment on development, psychosocial adjustment and Braille transcription skills.

Graduate Staff

ED 514 Formative Ideas in American Education. *Preq.: Six hours ED or PSY or CI. 3(3-0) F.* A consideration of the theory and practice of American education as an extension of the philosophical climate of opinion of different intellectual ages and how the present status of our educational system is grounded in the thought of the past.

Beezer

ED 515 Education and Social Diversity. *Preq.: Six hours ED, PSY and/or social science. 3(3-0) Alt. S.* An overview of the role of education within a culturally diverse society. Major attention is directed to racial, ethnic, socioeconomic and regional subpopulations. Among the issues to be discussed are the subcultural influences on public school performances, equality of educational opportunity, social stratification and mobility and the impact of schooling on intergroup relations.

Serow

ED 516 Community Occupational Surveys. *Preq.: Grad. standing or PBS status. 2(2-0) S.* Methods in organizing and conducting local surveys and evaluation of findings in planning a program of occupational education.

Graduate Staff

ED 517 Administrative Technology in Education. *Preqs.: ED 550 or equivalent and ED 532 or equivalent or CI. 3(3-0) S. Alt. yrs.* Designed to provide professional educators and human service planners with planning and management techniques using current information and communication technologies. Students use both equipment and procedural applications for financial planning, data base management, case management, scheduling, modeling and other management techniques.

Ballenger, MacPhail-Wilcox

ED 518 Introduction to Education Law. *Preq.: Six hours graduate credit. 3(3-0) S.* A study of constitutional, statutory and case law as it relates to the elementary and secondary public school settings, particularly in the areas of students, teachers and liability. Particular emphasis is placed on North Carolina and federal law.

Beezer

ED 519 Early Childhood Education. *Preq.: PSY 475 or PSY 576. 3(1-4) S.Sum.* Planning, selecting and using human resources, activities, materials and facilities in the education of young children. Student observation, participation and evaluation of educational experiences for the developmental level of individual children for an optimum learning environment. A synthesis of the student's knowledge of human development, learning theory and research findings as related to classroom application.

Graduate Staff

ED 520 Introduction to Guidance and Counseling. *Preq.: Six hours in ED or PSY. 3(3-0) F,S,Sum.* An introduction to the philosophies, theories, principles and issues of guidance and counseling services, with major emphasis on guidance at the secondary school level.

Graduate Staff

ED 521 Internship in Guidance and Personnel Services. *Preqs.: Eighteen hours in department and CI. Credits Arranged. F,S.* A continuous full-time internship of at least one-half semester. Framework of school and community. Work with students, teachers, administrators, guidance and pupil personnel workers, parents and resource personnel in the community. Supervision of intern by guidance personnel in school as well as by course instructors.

Graduate Staff

ED 522 Career Exploration. *Preq.: 12 hours ED or CI. 3(3-0) F,S,Sum.* This course is designed for teachers in the public schools of North Carolina who teach in "Career Exploration" programs. The course emphasizes the philosophy of career exploration, theories supporting career exploration, the place of exploration programs in the overall school curriculum, correlation of occupational information in academic subjects, sources of occupational information and its use and approaches to teaching in a career exploration program.

Clary, Dillon

ED 523 Orientation and Mobility of the Visually Impaired. *Preq.: CI. 3(3-0) F.* The sensory processes and sensory cues on which independent mobility depends for the visually impaired person. Various techniques and modes of travel considered. Emphasis given to instruction and background which will enable person not teaching orientation mobility as a skill to reinforce the learning that takes place in other situations.

Graduate Staff

ED 524 Career Counseling and Development. *Preq.: Six hours of ED or PSY. 3(3-0) F,S,Sum.* Knowledge and skills needed to: (a) provide professional career counseling to individuals and (b) design, implement and evaluate career development programs for particular groups. Areas of study include: theories of career development and decision making; career guidance programs in educational, agency and industrial setting; career information sources and delivery systems; and assessment in career counseling.

Gerler, Jones

ED 525 Advanced Trade Analysis and Course Construction. *Preq.: 12 hours ED or CI. 3(3-0) F.* Principles and practices in analyzing occupations for the purpose of determining teaching content. Practice in the principles underlying industrial course organization based on occupational analysis covering instruction skills and technology and including course outlines, job sequences, the development of industrial materials and instructional schedules.

Graduate Staff

ED 526 Teaching in College. *3(3-0) Sum.* This course focuses on the development of competencies to perform the fundamental tasks of a college teacher as well as consideration of more long-range tasks such as course development and the university responsibilities of a professor. In addition to attending lectures and other types of presentations, students will make video tapes of their teaching, develop tests, design introductory courses in their teaching fields and consider current issues related to university and college teaching.

Anderson

ED 527 Philosophy of Occupational Education. *Preq.: 12 hours ED or CI. 3(3-0) F,S.* An historical and philosophical investigation into the social and economic aspects of occupational education; an overview of the broad field of occupational education for youth and adults, with emphasis upon the trends and problems connected with the conduct of occupational education under federal and state guidance. An overview study of federal and state legislation pertaining to occupational education.

Graduate Staff

ED 528 Cooperative Occupational Education. *Preq.: Grad. standing or PBS status. 3(3-0) F,S.* Designed for individuals preparing to be directors, administrators or supervisors of oc-

cupational education programs at the local, state and/or national levels. Emphasis on organization and operation of cooperative occupational education programs. Covers the entire field of cooperative occupational education on secondary, postsecondary and adult levels with references to accepted essentials of cooperative education so details of planning, organization, establishment and operation of cooperative occupational programs will be practical and meaningful. Student visitations to existing quality programs in cooperative occupational education to study on-site conditions in specialized areas. Dillon

ED 529 Curriculum Materials Development. *Preqs.: Grad. standing and ED 527 or ED 630 or equivalent. 3(3-0) S.* Selection and organization of curricula and instructional materials in occupational education. Dillon

ED 530 Theories and Techniques of Counseling. *Preq.: Six hours of ED or PSY; Coreq.: ED 520 or equivalent. 3(3-0) F,S,Sum.* A combination of the study of theory and philosophy in counseling with techniques of counseling. Topics to be examined include behavioral approaches, psychoanalytic approaches, client-centered counseling, existential counseling and relationship models, and their relation to counseling. For each theory, the techniques are related to the theoretical concepts and principles. Locke

ED (PSY) 531 Mental Retardation. *Preq.: ED 506 or CI. 3(3-0) F.* The definitions, classifications, diagnostic and treatment procedures for mental retardation are examined from medical, sociological and educational points of view. Categories of retardation examined include mild, moderate, severe and profound. Graduate Staff

ED 532 Introduction to Educational Inquiry. *Preq.: Grad. standing or PBS status. 3(3-0) F,S,Sum.* A survey of basic concepts and methods of educational inquiry. Emphasis is on the logic underlying various approaches to problem definition and solution and on the tools of the investigator, as well as on sources and interpretation of research information related to the student's particular area of study. Marshall

ED 533 Group Counseling. *Preq.: ED 530. 3(3-0) S,Sum.* A study of the theory and principles of effective group work and the skills necessary for using specific counseling techniques, for the planning and organization of group counseling activities in the elementary school, secondary school or other institutions. Supervised experience provides, to a limited extent, practice in the use of various techniques of group leadership in the area of interest for each student. Gerler, Locke

ED 534 Guidance in Elementary and Middle Schools. *Preq.: Six hours in ED or PSY. 3(3-0) F.* Introduces teachers, counselors and school administrators to the theory, practice and organization of elementary and middle school guidance programs. Gerler

ED 535 Student Personnel Work in Higher Education. *Preq.: Nine hours PSY or CI. 3(3-0) F.* Examines practices in various areas of student personnel work. Studies both structure and function of student personnel programs in higher education. McVay

ED 536 Structure and Function of the Eye and Use of Low Vision. *Preq.: CI. 3(3-0) F.* Special institute for participants to spend minimum of 45 hours in class and class related activities. Medical and educational consultants discuss structure and function of the eye, eye anomalies affecting children with low vision, methods of teaching children to use minimal vision effectively. Graduate Staff

ED 537 The Extension and Public Service Function in Higher Education. *Preq.: ED 510. 3(3-0) S.* An examination of the background, history, philosophy and contemporary nature of the extension and public service function of institutions of higher education in the United States. Emphasis is placed on the adult education role of public and private universities and colleges. Specific focus is on: general extension, industrial extension, engineering extension, cooperative extension and continuing education. Graduate Staff

ED 538 Instructional Strategies in Adult and Community College Education. *Preq.: Grad. standing or PBS status. 3(3-0) F.* This course examines forms of instruction appropriate for the teaching of adults. Special emphasis will be placed upon methods which maximally involve the adult learner. The study of concepts, theories and principles relevant to the selection, utilization and evaluation of instructional strategies will focus on the integration of theory into practice. Through participation in classroom exercises, the student will develop proficiency in using teaching techniques which are applicable in adult and community college education. Graduate Staff

ED 539 Educational Gerontology. *Preq.: Six hours in ED, SOC or PSY. 3(3-0) F.* A broad overview of factors associated with the education of older adults. Various sociological, physiological, psychological and economic aspects of aging are explored in terms of their educational implications. Attention is given to knowledge and skills required for the development of educational programs for the aging population. Graduate Staff

ED 540 Career/Vocational Education for the Handicapped. *Preqs.: ED 506 and ED 527 or CI. 3(3-0) S.* Relevant definitions and current legislation and policies are reviewed. Appropriate curriculum, methods and materials are studied. Topic areas include program development, vocational evaluation, job placement and support services for the handicapped. Clary

ED 541A Practicum in Occupational Education. *Preq.: Grad. standing or PBS status. 1-6 F,S.* Under a faculty-supervised practicum in an educational, industrial or governmental setting, the student participates in and analyzes activities associated with the planning, implementation and evaluation of instructional programs or services in vocational education. A unique plan is developed by the student and approved by the supervisor. Clary

ED 541B Practicum in Education Administration. *Preqs.: ED 550 and CI. 1-6 F,S.* Supervised experience in an appropriate educational setting to enable the student to gain practice in applying concepts, principles and theories of education administration. Graduate Staff

ED 542 Contemporary Approaches in the Teaching of Social Studies. *Preqs.: Advanced undergrad. or grad. standing; must have completed student teaching. 3(3-0) S.* An analysis of the principles, strategies and application of new teaching approaches. Preinstructional activities, methods that focus on the individual and group and instructional developments and trends are explored. Harper, Martorella

ED 543 Adulthood and Learning: The Later Years. *Preq.: ED 539 or CI. 3(3-0) S. Alt. yrs.* A study of basic sensory, attitudinal, intellectual and emotional changes that occur in individuals during the process of growing old and the implications of these changes for developing, implementing and evaluating educational programs for and with older adults. Glass

ED 544 The Teaching of Composition. *Preq.: 9 hours of ED, PSY and/or ENG. 3(3-0) S.* For classroom teachers. Offers practical field-tested ideas to help students improve as writers by focusing on composition as a process as well as a product. Activities for teaching prewriting, composing, revising, proofreading, grammar and evaluating will be practiced, with suggestions for individual group learning. Research related to effective composition teaching will be reviewed. Pritchard

ED 545 Developmental Reading Instruction. *Preqs.: Twelve hours of ED or PSY and CI. 3(3-0) F.* A study of current methods and materials for the teaching of developmental and remedial reading, with emphasis on planning and implementing instructional programs for children with reading competencies from prereading through grade six. Fox

ED 546 Principles and Practices of Secondary School Reading Instruction. *Preqs.: Twelve hours in ED or PSY and CI. 3(3-0) F.S.* A study of principles and practices of teaching reading at the secondary school level, including reading instruction in the content areas.
Graduate Staff

ED 547 Analysis of Reading Abilities. *Preqs.: ED 545 or ED 546 and CI. 3(3-0) F.* A study of tests and techniques in determining specific abilities; a study of reading retardation and factors underlying reading difficulties.
Fox

ED 548 Development of Microcomputer Software for Instruction. *Preq.: Six hrs. ED or PSY or CI. 3(3-1) F.* Course topics covered are the instructional design principles underlying the development of microcomputer-based instructional software and accompanying materials and programming principles and their implementation in courseware development. Additional topics include authoring languages, programming languages and graphics.
Vasu

ED 549 Reading for the Middle Years. *Preq.: Twelve hours in ED or PSY. 3(3-0) Alt. S.* An investigation of issues related to middle years reading development, transition of reading skills to content areas and aspects of middle years reading program organization.
Fox

ED 550 Principles of Educational Administration. *Preqs.: Grad. standing, CI. 3(3-0) F.S.* This course is designed as an introductory course in educational administration. Emphasizing basic principles of administration, the course will draw upon administrative theory, business and public administration models as well as theoretical constructs from various disciplines.
MacPhail-Wilcox

ED 551 Principles and Practices of Supervision. *Preqs.: 6 semester hours ED/PSY graduate study and CI. 3(3-0) S.* Designed to provide the educational leader with an understanding of the nature of instructional supervision, skills needed in supervising educational programs and an analysis of promising practices for improving programs. Opportunity is provided for application of principles of supervision to one or more practical problems.
Parramore

ED 552 Industrial Arts in the Elementary School. *Preqs.: Twelve hours ED, CI. 3(3-0) Sum.* This course is organized to help elementary teachers and principals understand how tools, materials and industrial processes may be used to vitalize and supplement the elementary school child's experiences. Practical children's projects along with the building of classroom equipment.
Graduate Staff

ED (PSY) 553 Community Service Agencies. *Preq.: Six semester hours of ED, PSY or SOC or CI. 3(3-0) F.* An introduction to the issues, functions, and scope of the work being done in various human service agency programs; an overview of helping approaches with selected client populations; related professional concerns will be examined.
Sprinthall

ED 554 Planning Programs in Agricultural Education. *Preq.: Grad. standing or PBS status. 3(3-0) F.S.* Consideration of the need for planning programs in education; objectives and evaluation of community programs; use of advisory group; organization and use of facilities.
Graduate Staff

ED 555 Issues and Trends in Education for the Allied Health Professions. *Preq.: Grad. standing or CI. 3(3-0) Alt. yrs.* An analysis of educational and social factors influencing change in health professions education. Emphasis will be on problems of student selection and program articulation and the implications for health occupations education and health services of recent legislation regarding the handicapped.
Nunley

ED 556 Learning Disabilities. *Preq.: ED 506 or CI. 3(3-0) F.* A study of the field of learning disabilities, including definitions, prevalence, etiology, characteristics and current educational trends for educating learning disabled students. Crossland

ED 557 Methods and Materials in Learning Disabilities. *Preq.: ED 556 or CI. 3(3-0) S.* A study of the current methods and materials for the teaching of learning disabled students in the elementary and/or secondary schools, including curriculum and instructional techniques. Course will focus on examination of commercial materials and the development of teacher-made materials for use with the learning disabled student. Crossland

ED 558 Resource Teaching in Special Education. *Preq.: ED 506 or CI. 3(3-0) F.* A study of resource teaching in the area of special education, with emphasis on resource teaching with the learning disabled and mentally retarded. Course will focus on types of resource programs, how to establish and maintain a program, selection of students, curriculum and materials. Graduate Staff

ED 559 The Adult Learner. *Preq.: Six hours in ED. 3(3-0) S.* Principles involved in adult education programs including theories and concepts undergirding and requisite to these programs. Emphasis will be given to interrelationship of the nature of adult learning, the nature of the subject matter and the setting in which learning occurs. The applicability of relevant principles and pertinent research findings to adult learning will be thoroughly treated. Graduate Staff

ED 560 Teaching through the Arts. *Preq.: 6 hrs. in ED and/or PSY. 3(3-0) F. Alt. yrs.* Examines the role of the arts in the teaching/learning process, emphasizing ways classroom teachers can use the arts to foster students' personal growth, creativity and academic achievement. Develops teaching skills through explorations in graphic arts, sculpture, dance/movement, drama, film, creative writing and poetry. Graduate Staff

ED 561 Educational Diagnosis and Prescription for Exceptional Children. *Preq.: ED 506 or CI. 3(3-0) S.* A study of the concept of educational diagnosis of exceptional students, including an examination of educational diagnostic procedures in current use in special education. Course will focus on the development of informal diagnostic techniques and procedures for adapting curriculum and instruction for the exceptional learner. Graduate Staff

ED 562 Communication Disorders in the Classroom. *Preq.: ED 506 or CI. 3(3-0) S. Alt. yrs.* A study of communication disorders which occur in the school age population, including types of disorders, prevalence, etiology, characteristics and corrective therapy. Course will focus on communication disorders among exceptional students and the classroom teacher's role in working with communication disorders. Crossland

ED 563 Effective Teaching. *Preq.: Twelve hours ED including student teaching. 3(3-0) F,S,Sum.* Analysis of the teaching-learning process; assumptions that underlie course approaches; identifying problems of importance; problem solution for effective learning; evaluation of teaching and learning; making specific plans for effective teaching. Graduate Staff

ED 564 Classroom Management in Special Education. *Preq.: ED 506 or CI. 3(3-0) S.* A study of the concepts and procedures involved in the design and implementation of techniques for managing exceptional students in a classroom setting. Course will focus on methods for increasing and maintaining appropriate classroom behaviors in exceptional learners. Graduate Staff

ED 565 Agricultural Occupations. *Preq.: 12 hours ED or CI. 3(3-0) F,S.* The theory of education and work is related to the expanding field of agricultural occupations. Career development in agricultural occupations is associated with curriculum development needs.

Occupational experience in agriculture is seen in relation to the curriculum and the placement in agricultural occupations. Graduate Staff

ED 566 Occupational Experience in Agriculture. *Preq.: Grad. standing or PBS status. 3(3-0) F,S.* A major and critical element in all programs of vocational education is the provision for appropriate student learning experiences in a real and simulated employment environment. Due to recent developments in education and agriculture, new and expanded concepts of occupational experience have been devised. Current research substantiates the need and desire of teachers of agriculture for assistance in implementing the new concepts. The course is designed not only to provide this aid but to develop a depth of understanding of the theoretical foundations underlying the new developments in occupational experiences to stimulate individual growth and creativity in implementing further developments. Graduate Staff

ED 567 Concepts and Strategies of Understanding, Motivating and Teaching Disadvantaged Adults. *Preqs.: Advanced undergrad., CI. 3(3-0) S,Sum.* Designed to help adult educators acquire a comprehensive understanding of the educational, psychological, social, cultural and economic problems of the culturally deprived segments of society. In-depth explorations of the theoretical basis for understanding, motivating and teaching disadvantaged adults will be interwoven with practical application of these bases to specific educational opportunities with the disadvantaged adult learner. Graduate Staff

ED 568 Adult Education in Agriculture. *Preq.: Grad. standing or PBS status. 3(3-0) F,S.* Designed to meet the needs of leaders in adult education. Opportunity to study some of the basic problems and values in working with adult groups. Attention will be given to the problem of fitting the educational program for adults into the public school program and other educational programs as well as to the methods of teaching adults. Graduate Staff

ED 569 The Principalship. *Preq.: ED 550 or CI. 3(3-0) S. Alt. yrs.* A survey course covering the major responsibilities and tasks of a school principal, e.g., curriculum and instructional leadership, teacher recruitment and selection, fiscal record keeping, pupil schedules, plant management. Students will combine findings from their readings with present practices to develop workable solutions to managerial and instructional problems. MacPhail-Wilcox

ED 570 Foundations of Mathematics Education. *Preq.: ED 471 or equivalent. 3(3-0) Sum.* A course on the current status of mathematics education with special emphasis on the study and critical analysis of current practices in mathematics instruction from elementary school through college. Graduate Staff

ED 571 Introduction to the Gifted Individual. *Preq.: ED 506 or CI. 3(3-0) F.* A study of theories and concepts of giftedness and procedures in identifying the gifted, with a consideration of factors influencing giftedness and ways it may be fostered. Aubrecht

ED 572 Methods for Teaching the Gifted. *Preq.: ED 571 or CI. 3(3-0) S.* A study of major approaches used in the education of the gifted, including an opportunity to develop a unit plan based upon one of these approaches. Aubrecht

ED 573 Behavior Disorders. *Preq.: ED 506 or CI. 3(3-0) F.* A study of definitions, etiology, characteristics, philosophies and approaches to educational programming for children and youth with behavior disorders, including the emotionally handicapped, autistic and socially maladjusted. Graduate Staff

ED 574 Methods and Materials: Behavior Disorders. *Preq.: ED 573 or CI. 3(3-0) S.* A study of curriculum materials, instructional strategies and behavior management techniques related to teaching behaviorally disordered children and youth, including individualized instruction, group process, organization and evaluation of classroom programs, parent involvement, community resources and teachers' personal and professional growth and development. Graduate Staff

ED 575 Foundations of Science Education. *Preq.: ED 475 or equivalent. 3(3-0) S, Sum. Alt. yrs.* Study and analysis of the philosophical, historical, sociological, political and economic factors affecting science education in the schools of the United States. Implications for science education of various learning theories are examined along with models for curriculum development and program planning. Critical analysis of current trends, issues and problems in science education in terms of multiple perspectives.

Anderson, Wheatley

ED 576 Teaching/Learning Approaches for Emerging Adolescents. *Preqs.: ED 507 or equivalent; grad standing and CI. 3(3-0) S.* Exploration of teaching/learning approaches appropriate to emerging adolescents. Topics include learning styles; interdisciplinary inquiry; community-based curriculum; simulations and games; learning centers; mini-courses; design of physical space; all-school activities.

Arnold

ED 577 Improving Classroom Instruction in Science. *Preq.: ED 475 or equivalent. 3(3-0) F, S.* Application of major principles of education and psychology to the improvement of science teaching in elementary, middle and secondary schools. Emphasis on critical analysis of research and the development of research-based classroom applications. Topics include goals and objectives of science teaching, instructional strategies, development or selection of science materials, evaluation of achievement and elements of a desirable classroom climate.

Graduate Staff

ED 578 Law and Higher Education. *Preq.: Six hours grad. credit. 3(3-0) S. Alt. yrs.* A study of constitutional, statutory and case law as it relates to higher education. Emphasis is on faculty, student and staff rights and tort liability.

Beezer

ED 579 Concepts and Principles of Evaluation Applied to Non-formal Adult Education Programs. *Preq.: ED 503 or CI. 3(3-0) S.* Introduction to the evaluation of non-formal adult educational programs; course topics include the purposes of evaluation, alternative concepts and techniques, stake holders and their concerns, the specification of evidence, selection of standards for making judgments, gathering and analysis of data, use and dissemination of results and handling problems in evaluation.

Wright

ED 580 Evaluation Theory and Practice in Education. *Preq.: ED 532 or equivalent. 3(3-0) F.* A review of educational program evaluation with emphasis on (1) theory and conceptual models of evaluation, (2) evaluation design, and (3) environmental practical factors influencing the design and implementation of evaluation studies.

Marshall

ED 581 Curriculum and Instruction in the Allied Health Professions. *Preqs.: Advanced undergrad. or grad. standing and CI. 3(3-0) Alt. yrs.* A study of the elements of curriculum design and theoretical considerations for the development of curricula in the health occupations. Identification, analysis and evaluation of instructional strategies appropriate for clinical and classroom teaching.

Nunley

ED 582 Teaching Braille and Communication Skills. *Preqs.: ED 513 and ED 545 or equivalent. 3(3-0) S.* Information-access methods for visually impaired learners. Methods and materials for teaching Braille reading and selecting and teaching the use of electronic aids.

Graduate Staff

ED 583 Design and Evaluation of Instructional Materials. *Preq.: ED 483 or CI. 3(3-0) S, Sum.* Emphasis is upon the characteristics and selection of various media for instruction and their use in educational settings. Instructional materials will be designed and produced. Analysis of the research in the field is conducted. Projects and assignments are individualized in the areas of slide/tape, instructional television, instructional computing, graphic design and transparencies.

Martorella

ED 584 Health Care Delivery Systems and Environments. *Preqs.: Grad. standing and CI. 3(3-0) Alt. yrs.* Organization of the health care delivery system, services and resources. Focus on the major social, economic, political and professional factors which contribute to shaping the system and influence change. Organizations and environments are analyzed in regard to the demand for health manpower and the implications for health occupations education. Turnbull

ED 585 Community Education. *Preqs.: ED 503 and SOC 513. 3(3-0) S.* This course explores non-formal approaches to education in community settings. History and philosophy of community education, models of institutional response to community, functional dimensions of community education and community education planning are analyzed within the context of matching resources to needs. Students will develop knowledge and skill in the designing of community education as a process and a product. Graduate Staff

ED 586 Methods and Materials in Visual Impairments. *Preqs.: ED 506, ED 513. 3(3-0) S.* A study of current methods and materials for teaching visually impaired learners. Includes curriculum and materials development, adaptation, instructional techniques, educational assessment and diagnosis. Graduate Staff

ED 588 Advanced Teaching Methods in Industrial Arts Education. *Preq.: ED 362 or equivalent. 3(2-2) F,Sum.* An intensive examination of the teaching-learning process applicable to laboratory-classroom instruction. Instructional technology, evaluation, classroom control and management will be given attention. Wenig, Graduate Staff

ED 589 Central Office Administration. *Preq.: ED 550 or equivalent. 3(3-0) F. Alt. yrs.* A course covering the major responsibilities (except curriculum) of central office administrators in public school districts, *e.g.*, pupil assignments, business affairs, personnel administration, construction and maintenance. Students will combine findings from their readings with present practices to develop workable procedures for solving managerial problems. McPhail-Wilcox

ED 590 Special Problems in Guidance. *Preqs.: Six hours grad. work in department or equivalent and CI. Maximum 6 F,S.* Intended for individual or group studies of one or more of the major problems in guidance and personnel work. Problems will be selected to meet the interests of individuals. The workshop procedure will be used whereby special projects, reports and research will be developed by individuals and by groups. Graduate Staff

ED 591 Special Problems in Industrial Education. *Preqs.: Six hours grad. credit in industrial and technical education and CI. Maximum 6 F,S.* Directed individualized study and analysis in specialized areas of trade, industrial or technical subjects. Graduate Staff

ED 592 Special Problems in Mathematics Teaching. *Preq.: ED 471 or equivalent. 1-3 F,S,Sum.* An in-depth investigation of topical problems in mathematics teaching chosen from the areas of curriculum, methodology, technology, supervision and research. Graduate Staff

ED 593 Special Problems in Agricultural Education. *Preqs.: Six hours grad. credit in agricultural education and CI. Credits Arranged. F,S,Sum.* Opportunities for students to study current problems under the guidance of the staff. Graduate Staff

ED 594 Special Problems in Science Teaching. *Preq.: ED 476 or equivalent. 1-6 Sum.* An in-depth investigation of topics in science education not covered in existing courses. Includes critical analysis of research and may include field work. May be offered on individual basis or as a class. Anderson, Howe, Wheatley

ED 596 Topical Problems in Adult and Community College Education. *Preq.: Grad. standing or PBS status. Credits arranged. F,S,Sum.* Study and scientific analysis of problems in adult education and preparation of a scholarly research type of paper.

Graduate Staff

ED 597 Special Problems in Education. *Preq.: Grad. standing or PBS status. 1-3 F,S,Sum.* Designed to provide graduate students in education opportunity to study problem areas in professional education under the direction of a member of the graduate faculty.

Graduate Staff

ED 598 Special Problems in Curriculum and Instruction. *Preqs.: Six hours of ED or PSY and CI. 1-6 F,S,Sum.* Designed to provide an in-depth study of topical problems in curriculum and instruction selected from the areas of current concern to practitioners in education.

Graduate Staff

ED 599 Research Projects in Education. *Preqs.: CI; ED 532 or equivalent. 1-3 F,S,Sum.* A project or problem in research in education for graduate students, supervised by members of the graduate faculty. The research will be chosen on the basis of individual students' interests and is not to be part of thesis or dissertation research.

Graduate Staff

FOR GRADUATES ONLY

ED 600 Organizational Concepts and Theories Applied to Adult and Community College Education. *Preqs.: ED 503, PS 502, SOC 541. 3(3-0) F.* This course is designed for present and potential administrators interested in increasing their understanding of organization as a basis for administering effective adult and community college education programs.

Graduate Staff

ED 601 Administrative Concepts and Theories Applied to Adult and Community College Education. *Preq.: ED 600 or a comparable course(s) on organizational theory. 3(3-0) S.* Designed for persons interested in building a more consistent philosophy of educational administration, extending and strengthening their understanding of administrative concepts and processes, improving their comprehension of the theoretical and research foundations upon which administrative processes are predicated, and increasing their ability to apply administrative concepts, theories and principles to the management of the complex education system.

Graduate Staff

ED 602 Curriculum Theory and Development. *Preqs.: 9 semester hours graduate PSY, ED 502, ED 514 or CI. 3(3-0) S.* A study of theory and research in the behavioral sciences and education designed to provide the theoretical background for the development of elementary and secondary curricula. The knowledge base and skills for critical review of curricula and instructional materials are explored and an opportunity to apply these is provided.

Parramore

ED 603 Teaching Mathematics and Science in Higher Education. *Preqs.: ED 570, 592 or 594, grad. standing, CI. 3(3-0) F.* Collegiate mathematics and science instruction is examined with respect to goals and objectives, design of courses and curricula, innovative programs and facilities, and methods and materials for instruction.

Graduate Staff

ED 604 Curriculum Development and Evaluation in Science and Mathematics. *Preqs.: 500-level statistics, ED 615 or PSY 535, CI. 3(3-0) S.* A critical study of the elements of curriculum design and theory in mathematics education and science education and the examination of evaluation procedures for assessing educational innovations.

Graduate Staff

ED 605 Education and Supervision of Teachers of Mathematics and Science. *Preqs.: ED 470 or 475 or equivalent, ED 570 or 592 or 594. 3(3-0) S.* Critical analysis of theories,

programs and techniques designed to promote interpersonal interactions that will lead to more effective teaching of science and mathematics.

Graduate Staff

ED 606 Remediation of Reading Disabilities. *Preq.: ED 547 or CI. 3(3-0) S.* Advanced approaches to reading remediation are examined including theory and research related to remedial instructional strategies, analyses of instructional designs and evaluations of the effectiveness of intervention programs.

Fox

ED (PS) 607 The Politics of Higher Education. *3(3-0).* (See political science and public administration.)

ED 608 Supervision of Occupational Education. *Preq.: ED 527 or ED 630. 3(3-0) F.* An intensive study of the principles of supervision and the applications of these principles to the occupational education programs being conducted in secondary, postsecondary and adult facilities. Emphasis is placed upon the competencies needed in supervisors in order to effectively discharge their responsibilities in such areas as teacher selection, teacher transfer and promotion, assistance in teacher professional growth, the conduct of workshops and in-service programs for professional and non-professional staff, self-evaluative processes in education, curriculum generation and modification, guidance and counseling provisions and action research.

Clary

ED 609 Planning and Organizing Industrial and Technical Education Programs. *Preqs.: ED 516 and grad. standing. 3(3-0) F.* In this course a study will be made of the influences which impinge upon the development of programs of occupational education. Adequate opportunity will also be provided to examine in detail steps that may be taken to analyze needs for occupational education, to organize for its provision, to study its offerings and to evaluate its results.

Graduate Staff

ED 610 Administration of Occupational Education. *Preq.: ED 527 or ED 630. 3(3-0) S. Alt. yrs.* An intensive study of the major elements of administrative practice applied to occupational education, as it is being conducted in comprehensive high schools, comprehensive community colleges, technical institutes and area vocational centers. Emphasis is placed upon leadership, personnel management, instructional program management and evaluation, public relations and financial management, in connection with preparatory, part-time, supplementary, extension and adult education program of occupational education.

Belcher, Clary

ED 611 Laws, Regulations and Policies Affecting Occupational Education. *Preq.: ED 527 or ED 630. 3(3-0) S.* A detailed study of legislation (national and state) which applies directly to occupational education. Basic social issues and economic conditions which precipitated the legislation will be studied in depth. A review will also be made of the organizational structure and policies under which national legislation is converted into programs of occupational education.

Farmer

ED 612 Finance, Accounting and Management of Occupational Education Programs. *Preq.: ED 610. 3(3-0) S. Alt. yrs.* A study of the steps which must be taken in financing a new occupational enterprise, following the determination of curriculum by area study. All financial transactions such as costs of operation, equipment purchase procedures and costs for construction will be investigated in detail.

Belcher

ED 614 Contemporary Educational Thought. *Preqs.: Twelve hours ED; CI. 3(3-0) S. Alt. yrs.* This course will be based on a reading and discussion of twentieth-century works in educational philosophy. Such movements as pragmatism, reconstruction, perennialism and existentialism will be considered.

Graduate Staff

ED 615 Special Topics in Health Occupations Education. *Preqs.: 15 semester hrs. and CI. 3-5 F,S,Sum.* Guided independent study of topics that complement the student's program of work and professional goals.

Davis

ED 616 History of Higher Education in the United States. *Preqs.: Six hours of grad. ED courses and CI. 3(3-0) S. Alt. yrs.* A study of the history of higher education from the colonial period to the present. Emphasis is on how philosophic, political, social and economic forces influence the function and structure of higher education. Graduate Staff

ED 618 School Law for the Administrator. *Preq.: ED 518 or equivalent. 3(3-0) S. Alt. yrs.* A comprehensive study of constitutional, statutory and case law as it relates to elementary and secondary school administration. Emphasis is on legal issues associated with governance, finance, property, personnel and curriculum. Beezer

ED 620 Cases in Educational Administration. *Preqs.: Grad. standing and CI. 3(3-0) S. Alt. yrs.* This course utilizes the case study and case simulation approach to the study of school administration. Administrative concepts will be developed and applied to simulated situations and to actual case histories. The administrative process is viewed as a decision-making process. The student will be expected to make decisions after considering alternative courses of action and after projecting probable consequences. Dolce

ED 621 Internship in Education. *Preqs.: Nine credit hours in grad. level courses and CI. 3-9 F.S.Sum.* Utilizing the participant-observer role, this course requires participation in selected educational situations with emphasis upon development of observational skills, ability to record relevant observations by means of written journals, skills in analyzing experiences identifying critical incidents and projection of events and consequences. The student is required to develop possible alternative courses of action in various situations, select one of the alternatives and evaluate the consequences of the course of action selected. Graduate Staff

ED 625 Cross Cultural Counseling. *Preqs.: ED 530; 9 semester hrs. grad.-level ED. 3(3-0) S.* Theory and practice of counseling culturally different clients. Client populations include African-Americans, Asian-Americans, American Indians and Hispanics. Topics include cultural assumptions, cultural values, counselor credibility, prejudice and racism in the context of counseling. Graduate Staff

ED 630 Philosophy of Industrial Arts Education. *Preq.: Twelve hours in ED. 3(3-0) S. Alt. yrs.* Origins, development of industrial arts education. Philosophical foundations, derivation of objectives and criteria for evaluation. Contributions of the heritage to contemporary concepts of industrial arts education. Young

ED 631 Vocational Development Theory. *Preq.: Grad. standing or PBS status. 3(3-0) F.* A study of the major theories and constructs of vocational development with implications for counseling and career planning. Jones

ED 632 Applied Research Methods in Education. *Preqs.: ST 507 and ED 532 or equivalent; Coreq.: ST 508 or CI. 3(1-4) S.* Through the use of simulated educational settings consideration will be given to the development of research proposals or plans, selection and/or development of appropriate measurement instruments and the purposes and functions of various statistical designs and procedures. Simulated data will be prepared and analyzed using computer-based statistical packages, the results will be interpreted and a research report will be produced. Marshall

ED 633 Development and Coordination of School Guidance Programs. *Preq.: Grad. standing or PBS status. 3(3-0) S.* A study of the tasks of organizing, coordinating, evaluating and changing school guidance programs by school counselors. Included are the study of goals, objectives, values, functions and evaluations as they are related to program development in the secondary and elementary school. Graduate Staff

ED 635 Administration and Supervision of Industrial Arts. *Preq.: Twelve hours in ED. 2(2-0) F.S.* Study of the problems and techniques of administration and supervision of in-

dustrial arts in schools and universities. Selection of teachers, teacher improvement methods, public relations, facilities planning and specification. Graduate Staff

ED 636 Observation and Supervised Field Work. *Preq.: CI. Maximum 3 F,S.* Provides opportunity for observation and practice of guidance and personnel services in schools, institutions of higher education, agencies, business and industry. Graduate Staff

ED 637 Seminar in Cognitive-Developmental Theory and Practice. *Preqs.: Advanced grad. standing and CI. 3(3-0) F. Alt. yrs.* Analysis of major contemporary theories of cognitive development (Erikson, Kohlberg, Loevinger, Hunt, Perry) as a basis for deliberate counseling and curricular interventions. Sprinthall

ED 638 Seminar in Cognitive-Development Research. *Preqs.: Grad. standing; ED 637; CI. 3(3-0) S. Alt. yrs.* A review of current systems of cognitive-developmental assessment; methods for measuring psychological growth will be included. Specific research design models will be reviewed as a basis for action-research. Sprinthall

ED 640 Laboratory Experiences in Counseling. *Preqs.: ED 520 or equivalent; PSY 535; Coreq.: ED 530. 3(3-0) F.* The identification and practice of fundamental skills needed for a person to function as an effective counselor. Emphasized is development of specific skills in: counseling, testing, human relations, identification of client problems and the design of counseling strategies. Graduate Staff

ED 641A Practicum in Counseling. *Preqs.: Advanced grad. standing, CI. 2-6 S.* A practicum course in which the student participates in actual counseling experience under supervision in a school, college or agency setting. Graduate Staff

ED 641B Practicum in Reading. *Preqs.: ED 545 or ED 546 and ED 547 and CI. 1-6 S.* Practicum designed to meet the particular needs of students enrolled. It may involve diagnosis of student abilities, design of a remedial program based on hypothesis concerning student abilities, implementation and evaluation of a remedial reading program, or the design of a reading clinic. Graduate Staff

ED 641C Practicum in Special Education. *Preq.: CI. 1-6 F,S.* Practicum will be designed to meet the individual needs of the students enrolled in the course. The practicum may involve diagnosis of exceptional students, writing educational prescriptive plans for exceptional students, or it may focus on an individual topic that involves working directly with exceptional learners. Graduate Staff

ED 641D Practicum in Science and Mathematics Education. *Preq.: ED 570 or ED 575. 1-6 F,S.* Supervised practicum in appropriate settings both on- and off-campus. Provides an opportunity for development, implementation and evaluation in science and mathematics in a clinical environment under faculty supervision. Graduate Staff

ED 641G Practicum in Middle Years Education. *Preqs.: ED 507 or equivalent; grad. standing and CI. 3-6 F,S.* Designed to provide practical experience in schools and area agencies concerned with middle and junior high school education. Arnold

ED 641J Practicum in Health Occupations. *Preqs.: 21 hrs. grad. work including ED 581 and CI. 3(3-0) Alt. yrs.* Based upon the participants' professional objectives, a practicum in a teaching or an administrative context will be designed appropriate to the individual's particular discipline and area of function. Program will be designed by the student in cooperation with the preceptor and course instructor. Davis

ED 641K Practicum in Supervision. *Preq.: ED 551 or equivalent. 3-6 F,S.* Practical experience in schools, school systems and area educational agencies concerned with instructional supervision. Parramore

ED 648 Theory and Process in Reading and Language Arts. *Preqs.: ED 545 and CI. 3(3-0) F. Alt. yrs.* Advanced study of theoretical models of reading, research issues in reading and in other language processes. Theoretical models of reading are studied in depth. Emphasis is placed on critical examination and analysis of research investigating reading acquisition, mature reading behavior and related language processes. Graduate Staff

ED 660 Industrial Arts Curriculum. *Preq.: IA 645. 3(3-0) F,S,Sum.* Industrial arts curriculum origins, analysis, organization, evaluation, revision. Subject matter deviation and classification applicable to all levels of instruction. Relationships among curriculum, philosophy and methodology. (Also see ED 608, ED 610, ED 630, ED 635 and ED 692.) Graduate Staff

ED 664 Supervision in Agricultural Education. *Preq.: ED 554. 3(3-0) F,S.* Organization, administration, evaluation and possible improvement of supervisory practice; theory, principles and techniques of effective supervision in agricultural education at different levels. Graduate Staff

ED 665 Supervising Student Teaching. *Preq.: Twelve hours of ED. 3(3-0) F,S,Sum.* A study of the program of student teaching in teacher education. Special consideration will be given the role of the supervising teacher, including the following areas: planning for effective student teaching, observation and orientation, school community study, analysis of situation, evaluating student teachers and coordination with North Carolina State University. Graduate Staff

ED 666 Supervision of Counseling. *Preq.: CI. 3(1-8) F,S.* A supervised practicum for doctoral students in assisting with the supervision of first-year students in laboratory and practicum experiences in individual or group counseling. Graduate Staff

ED 687 Seminar in Curriculum and Instruction. *Preqs.: Doctoral standing; ED 602 or CI. 1-3 F. Alt. yrs.* Consideration of contemporary issues, trends and recent research and development findings in curriculum and instruction. Graduate Staff

ED 688 Research Application in Occupational Education. *Preq.: ED 532. 3(3-0) F,S.* This course will be concerned with methodology, application, analysis and synthesis of research in occupational education. A review of current occupational education studies, clustered by areas, will be made with attention to statistical techniques, data collecting, data handling, and the audience and impact of particular projects and research organizations. The class activities in research application are designed to bridge the gap between the theories of research methodology and the student's independent research projects. Coster, Graduate Staff

ED 689 Evaluation in Occupational Education. *Preqs.: ED 532 and either ST 507, ST 511, ST 513 or CI. 3(3-0) F.* Concerned with the conceptual and methodological aspects of occupational education evaluation, with attention to techniques for determining empirically the extent to which educational goals are being achieved, to locate the barriers to the advancement of these goals and to discover the consequences of educational programCoster

ED 690 Seminar in Mathematics Education. *Preq.: Departmental major or CI. 2(2-0) F,S.* An in-depth examination and analysis of the literature and research in a particular topic(s) in mathematics education. Graduate Staff

ED 691 Seminar in Industrial Education. *Preqs.: Six hours grad. credit, including one 600-level course in industrial and technical education and CI. 1(1-0) S.* Reviews and reports of special interest to graduate students in industrial and technical education. The course will be offered in accordance with the availability of distinguished professors and in response to indicated needs of the graduate students. Graduate Staff

ED 692 Seminar in Industrial Arts Education. *Preq.: Grad. standing. 1(1-0) F.S.* Reviews and reports on special topics of interest to students in industrial arts education.

Graduate Staff

ED 693 Advanced Problems in Agricultural Education. *Preqs.: Six hours grad. credit, including one 600-level course in agricultural education and CI. Credits Arranged. F.S.* Study of current and advanced problems in the teaching and administration of educational programs, evaluation of procedures and consideration for improving.

Graduate Staff

ED 694 Seminar in Agricultural Education. *Preqs.: Six hours grad. credit, including one 600-level course in agricultural education and CI. 1(1-0) Maximum 2 F.* A critical review of current problems, articles and books of interest to students of agricultural education.

Graduate Staff

ED 695 Seminar in Science Education. *Preq.: Department major or CI. 2(2-0) F.S.* An in-depth examination and analysis of the literature and research in a particular topic(s) in science education.

Graduate Staff

ED 696 Seminar in Adult and Community College Education. *Preq.: Grad. standing. 1-3 F.S.* Identification and scientific analysis of major issues and problems relevant to adult education. Credit for this course will involve the active participation of the student in a formal seminar and scientific appraisal and solution of a selected problem. The course is designed to help the student acquire a broad perspective of issues confronting adult educators and to acquire experiences in the scientific analysis and solution of specific issues.

Graduate Staff

ED 697 Problems of Research Design in Education. *Preqs.: ED 632 and CI. 1-3 S. Alt. yrs.* Provides the student with an individualized but structured investigation of alternative problem definitions, research methodologies and statistical analyses for a problem of his/her choosing, usually associated with thesis or dissertation. In small groups or individually with the instructor, the student considers research design, measurements and statistical analysis necessary to conduct research.

Marshall

ED 698 Seminar in Occupational Education. *Preq.: ED 527 or ED 630. 3(3-0) F.S.* This course will be designed as a seminar-type course, with topics selected each semester. Attention will be given to the broad concepts of occupational education as manifested in the Vocational Education Act of 1963 and its amendments, and to the problems and issues underlying the development of and implementation of programs of occupational education at elementary, junior high, senior high and postsecondary levels.

Coster, Graduate Staff

ED 699 Thesis and Dissertation Research. *Preqs.: 15 hours of education; CI. Credits Arranged. F.S.* Sum. Individual research on a thesis or dissertation problem.

Graduate Staff

Electrical and Computer Engineering

GRADUATE FACULTY

Professor N. A. Masnari, Head

Associate Professor W. T. Easter, Associate Head

Associate Professor J. F. Kauffman, Graduate Administrator

Professors: D. P. Agrawal, W. E. Alexander, S. M. Bedair, W. Chou, A. J. Goetze, J. J. Grainger, J. R. Hauser, S. Khorram, M. A. Littlejohn, N. F. J. Matthews, L. K.

Montieth, H. T. Nagel Jr., J. B. O'Neal Jr., C. M. Osborn, A. Reisman, D. R. Rhodes, J. J. Wortman; *Adjunct Professors*: E. Christian, W. A. Flood, J. B. Suttle; *Visiting Professor*: H. W. Etzel; *Professors Emeriti*: W. J. Barclay, A. R. Eckels, G. B. Hoadley, W. D. Stevenson Jr., F. J. Tischer; *Associate Professors*: G. F. Bland, S. E. Diehl-Nagle, T. H. Glisson, W. A. Laidig, A. A. Nilsson, S. A. Rajala, W. E. Snyder, R. J. Trew, H. J. Trussell; *Adjunct Associate Professors*: J. R. Jones, S. H. Lee, H. R. Wittmann; *Associate Professors Emeriti*: N. R. Bell, E. G. Manning, W. C. Peterson; *Assistant Professors*: S. T. Alexander, E. F. Gehringer, W.-t. Liu, R.-C. Luo, D. L. Lubkeman, T. K. Miller III, J. J. Paulos, D. D. Stancil; *Visiting Assistant Professors*: R. Mehrotra, M. B. Steer; *Lecturers*: P. T. Hutchinson, P. Rastgoufard

The Department of Electrical and Computer Engineering offers the degrees of Master of Electrical Engineering, Master of Science with or without a thesis, and Doctor of Philosophy. Master of Science and Doctor of Philosophy degrees are offered in both electrical engineering and computer engineering. In either degree track, the student enrolled in either the M.S. with thesis, or the Ph.D. degree program must choose an area of emphasis. In the electrical engineering track, the areas are: solid-state communications, electromagnetics, circuits and power. In the computer engineering track, the areas are: digital systems, computer science, computer communications and systems software. Course work is available in other areas to support these areas of emphasis. The computer engineering track is a joint program with the Computer Science Department in which faculty members from both departments are actively involved in teaching, research and advising in the various emphasis areas.

The Master of Electrical Engineering degree requires a design project which may account for three to six credits. A specified number of design courses from an approved list must be included in the student's program of courses. The student must also pass a comprehensive oral examination.

Three core courses from an approved list are required for the Master of Science degree without a thesis, and the student must pass a comprehensive oral examination.

The Master of Science degree with thesis has no specified course requirements, but the student must pass a comprehensive oral examination. The thesis may account for as many as six semester hours.

In the more advanced study for the doctorate, a comprehensive understanding of three areas in electrical engineering or computer engineering is required, and specialization appears in part of the course program and in the research problem undertaken.

Advanced courses of a general and fundamental nature are required for those who plan to carry their advanced studies to the level of the doctorate. Minor sequences of study in advanced mathematics, physics or other appropriate disciplines are planned to fit individual needs.

The laboratories in the department are well equipped for research in communications, computers, VLSI design, electromagnetics, electro-optics, solid-state materials and devices, circuits and power systems. Research is in progress in these and other areas.

SELECTED ADVANCED UNDERGRADUATE COURSES

- ECE 401 Introduction to Signal Processing.** *Preqs.: ECE 301, ECE 302. 3(3-0) F,S.*
- ECE 409 Introduction to Telecommunications Engineering.** *Preq.: ECE 301. 3(3-0) F.*
- ECE 431 Electronics Engineering.** *Preq.: ECE 314. 3(2-3) F,S.*
- ECE 432 Communications Engineering.** *Preqs.: ECE 301, ECE 314. 3(2-3) S.*
- ECE 435 Elements of Control.** *Preqs.: ECE 305, ECE 314. 3(2-3) F.*
- ECE 436 Digital Control Systems.** *Preq.: ECE 435. 3(3-0) S.*
- ECE 439 Integrated Circuit Technology and Fabrication.** *Preq.: ECE 441. 3(2-2) S.*
- ECE (CSC) 440 Digital Systems Interfacing.** *Preq.: CSC 312 or ECE 340. 3(2-2) S.*
- ECE 441 Introduction to Solid-State Devices.** *Preqs.: ECE 303, ECE 314. 3(3-0) F.*
- ECE 444 Computer Control of Robots.** *Preqs.: ECE 314; and ECE 340 or ECE 212. 3(2-3) F,S.*
- ECE 446 VLSI Systems Design.** *Preqs.: ECE 314 and ECE 340 or ECE 212. 4(3-2) F,S.*
- ECE 448 Microwave Antennas, Radars and Communication Systems.** *Preq.: ECE 303. 3(3-0) F.*
- ECE 451 Power System Analysis.** *Preq.: ECE 305. 3(3-0) F.*
- ECE 452 Power Systems Protection.** *Preq.: ECE 451. 3(3-0) S.*
- ECE 454 Electrical Machinery.** *Preq.: ECE 305. 3(3-0) S.*
- ECE 455 Computer Control of SCR Motor Drives.** *Preq.: ECE 305 or ECE 331. 3(1-4) F,S.*
- ECE 457 Semiconductor Power Conversion.** *Preq.: ECE 314. 3(3-0) F.*
- ECE 492 Special Topics in Electrical and Computer Engineering.** *Preq.: CI. 1-4 F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

- ECE (CSC, CSE) 501 Design of Systems Programs.** *3(3-0) F.* (See computer studies.)
- ECE 503 Computer-Aided Circuit Analysis.** *Preqs.: ECE 314, 301, B average in ECE and MA. 3(3-0) F.* Analysis of electrical circuits with emphasis on computer methods. Steady-state and transient analysis of linear and nonlinear networks; tolerance analysis; programming considerations.
Graduate Staff
- ECE 504 Introduction to the Design of Transmission Networks.** *Preqs.: ECE 301, B average in ECE and MA. 3(3-0) S.* Introduction to modern design methods of transmission networks for specified loss, phase, delay or time specifications. To be discussed will be passive, active-RC and digital networks. Design methods will make extensive use of canned computer programs. This course is intended: (a) for engineers who may have to design transmission networks occasionally, (b) for those who specify such networks, (c) as a first introduction for further studies.
Graduate Staff

ECE (CSC, CSE) 506 Digital Systems Architecture. 3(3-0) F. (See computer studies.)

ECE (CSC, CSE) 510 Software Engineering. 3(3-0) F. (See computer studies.)

ECE 511 Analog Electronics. *Preqs.: ECE 431, grad. standing or B average in ECE and MA. 3(2-3) S.* A study of circuit and system applications of analog devices and integrated circuits. Performance characteristics and limitations of a wide variety of analog electronic devices and circuits will be considered. Selected laboratory projects are used to provide direct experience in advanced analog electronics. Graduate Staff

ECE (CSC, CSE) 512 Compiler Construction. 3(3-0) S. (See computer studies.)

ECE (CSE) 513 Digital Signal Processing. *Preqs.: ECE 401, B average in ECE and MA or CI. 3(3-0) F.* Digital processing of analog signals. Offline and real-time processing for parameter, waveshape and spectrum estimation. Digital filtering and applications in speech, sonar, radar, data processing, and two-dimensional filtering and image processing. Graduate Staff

ECE (CSE) 514 Random Processes. *Preqs.: ECE 301, B average in ECE and MA. 3(3-0) F.* Probabilistic descriptions of signals and noise, including joint, marginal and conditional densities, autocorrelation, cross-correlation and power spectral density. Linear and non-linear transformations. Linear least-squares estimation. Signal detection. Graduate Staff

ECE 516 System Control Engineering. *Preq.: ECE 435 or ECE 301. 3(3-0) F.* Introduction to analysis and design of continuous and discrete-time dynamical control systems. Emphasis on linear, single-input, single-output systems using state variable and transfer function methods. Topics include open and closed-loop representation; analog and digital simulation; time and frequency response; stability by Routh-Hurwitz, Nyquist and Liapunov methods; performance specifications; cascade and state variable compensation. Assignments utilize computer-aided analysis and design programs. Graduate Staff

ECE (CSC, CSE) 518 Computer Graphics. 3(3-0). (See computer studies.)

ECE (CSE) 520 Fundamentals of Logic Systems. *Preqs.: ECE 318, B average in ECE and MA. 3(3-0) F.* A study of algebraic structures as related to logic systems, models for switching circuit behavior and their relation to hardware implementation. Includes theoretical treatment of both combinational and sequential logic systems concepts. Graduate Staff

ECE (CSE) 521 Digital Computer Technology and Design. *Preq.: ECE 342. 3(3-3) F/S.* A study of the internal structure and organization of digital systems with the computer as a primary focus. The emphasis is on problem description and modeling as required in the design process. The design of all major components in digital systems, including memory, input-output and control utilizing current technology, will be discussed. Graduate Staff

ECE 530 Physical Electronics. *Preqs.: ECE 303, B average in ECE and MA. 3(3-0) F.* A study of the properties of charged particles under the influence of fields and in solid materials. Quantum mechanics, particle statistics, semi-conductor properties, fundamental particle transport properties and lasers. Graduate Staff

ECE 531 Principles of Transistor Devices. *Preq.: ECE 441. 3(3-0) S.* An analysis of the operating principles of transistor structures. Basic semiconductor physics are reviewed and used to provide an explanation of transistor characteristics. Device-equivalent circuits are developed and used to interpret semiconductor-imposed limitations on device performance. Devices analyzed include both metal oxide semiconductor and bipolar type transistor structures. Graduate Staff

ECE 532 Principles of Microwave Circuits. *Preq.: Grad. standing or B average in ECE and MA. 3(3-0) F.* Principles required to understand the behavior of electronic circuits operating at microwave frequencies. This course starts with a review of electromagnetic theory and establishes the millimeter techniques required for working with electronic circuits at microwave and wave frequencies. Circuit components that operate at these frequencies are discussed.
Graduate Staff

ECE (CSE) 533 Digital Electronics. *Preqs.: ECE 314, grad. standing or B average in ECE and MA. 3(3-0) S.* A study of digital electronic circuits and functions in integrated package form. Covers circuit analysis and performance parameters for many important circuit families.
Graduate Staff

ECE 537 Microwave Device Characterization Techniques. *Preq.: ECE 448. 3(1-5) F.* A laboratory in principles of microwave characterization and operation of microwave test equipment such as spectrum analyzers, power meters, detectors and network analyzers. Measurements of impedance noise figure, equivalent circuit parameters and frequency response will be performed on various circuit elements and devices.
Graduate Staff

ECE 539 Integrated Circuit Technology and Fabrication. *Preq.: ECE 441. 3(2-2) S.* A study of semiconductor device and integrated circuit processing and technology. Covers sample preparation and specification, oxidation, diffusion, ion implantation, photolithography, design rules and measurement techniques.
Graduate Staff

ECE 540 Electromagnetic Fields. *Preq.: ECE 448. 3(3-0) S.* A brief review of Maxwell's Equations, constitutive relations and boundary conditions. Power and energy relations for plane waves in isotropic and anisotropic media. Analysis of transmission lines, hollow metallic wave guides and dielectric waveguides. Green functions and applications to radiation and scattering. Electromagnetics and special relativity.
Graduate Staff

ECE (CSC, CSE) 542 Database Management. *3(3-0) F.* (See computer studies.)

ECE 545 Introduction to Radio Wave Propagation. *Preqs.: ECE 303, B average in ECE and MA. 3(3-0) F.* Characteristics of plane electromagnetic waves in homogeneous and non-homogeneous media with application to tropospheric and ionospheric propagation. Relationships between electron density, collision frequency and complex refractive index, theory of the formation and dynamics of ionospheric layers and theorems for the prediction of ionospheric propagation.
Graduate Staff

ECE 550 Power System Operation and Control. *Preqs.: ECE 305 or ECE 331, B average in ECE and MA. 3(3-0) F.* Fundamental concepts of economic operation and control of power systems. Real and reactive power balance. System components, characteristics and operation. Steady state and dynamic analysis of interconnected systems. Tieline power and load-frequency control with integrated economic dispatch.
Graduate Staff

ECE (PY) 552 Introduction to the Structure of Solids. *3(3-0) S.* (See physics.)

ECE (CSE) 558 Digital Image Processing. *Preqs.: ECE 401, ST 371, high-level programming capability. 3(3-0) Every yr.* Introduction to the basic techniques of image processing. Topics include image formation and perception, digitization, Fourier transform domain processing, restoration and tomographic reconstruction.
Graduate Staff

ECE (CSE) 559 Pattern Recognition. *Preqs.: ECE (CSE) 514, ST 371, B average in ECE and MA. 3(3-0) S.* A study of image pattern recognition techniques and computer-based methods for scene analysis, including discriminate functions, feature extraction, classification strategies, edge detection and Fourier image processing. Applications and current research results will be covered.
Graduate Staff

ECE (CSC, CSE, IE, OR) 562 Computer Simulation Techniques. 3(3-0) F. (See computer studies.)

ECE (MAE) 565 Gas Lasers. 3(3-0) F,S. (See mechanical and aerospace engineering.)

ECE (CSC, CSE) 571 Data Transmission/Communications. 3(3-0) S. (See computer studies.)

ECE (CSC, CSE) 572 Computer Communications. 3(3-0) F. (See computer studies.)

ECE (CSC, CSE) 574 Real Time Computer Systems. 3(3-0) Alt. S. (See computer studies.)

ECE 591, 592 Special Topics in Electrical Engineering. *Preq.: B average in technical subjects. 3(3-0) F,S.* A two-semester sequence to develop new courses and to allow qualified students to explore areas of special interest. Graduate Staff

ECE 593 Individual Topics in Electrical Engineering. *Preq.: B average in technical subjects. 1-3 F,S.* A course providing an opportunity for individual students to explore topics of special interest under the direction of a member of the faculty. Graduate Staff

FOR GRADUATES ONLY

ECE 613 Advanced Feedback Control. *Preq.: ECE 516. 3(3-0) S.* The study of advanced topics in dynamical systems and multivariable control. Current research and recent developments in the field will be treated. Graduate Staff

ECE 619 Microwave Circuits Design. *Preq.: ECE 532. 3(3-0) S. Alt. yrs.* Techniques for the design of microwave and millimeterwave systems and components. Radar and radiometer systems are introduced and discussed. System-imposed constraints upon component performance are introduced. Component function and design are analyzed. Specific topics include mixer, oscillator and amplifier performance and design. Students are required to design a selected component. Modern computer-aided design techniques are used. Graduate Staff

ECE 622 Electronic Properties of Solid-State Materials. *Preq.: ECE 530. 3(3-0) S.* A review of energy bands in semiconductors. Detailed treatment of thermal and electrical transport phenomena, equilibrium and non-equilibrium semiconductor statistics. Also optical properties and hot electron effects in solid-state materials. Graduate Staff

ECE 623 Optical Properties of Semiconductors. *Preq.: ECE 530. 3(3-0) F. Alt. yrs.* Materials and device-related properties of compound optical semiconductors are studied. Included topics are: optical constants, absorption and emission processes in semiconductors, photodetectors, LED's semiconductor lasers. Graduate Staff

ECE 624 Electronic Properties of Solid-State Devices. *Preq.: ECE 530. 3(3-0) S.* A study of the basic physical phenomena responsible for the operation of solid-state devices. The semiconductor equations are examined and utilized to explain basic principles of operation. Rectifying and ohmic contacts are examined. Various state-of-the-art devices are studied in detail. Graduate Staff

ECE 625 Advanced Solid-State Device Theory. *Preq.: ECE 624. 3(3-0) F.* A study of the latest developments in solid-state devices. Topics are selected from subjects of current interest and state-of-the-art results are discussed. Emphasis is on the basic fundamental physical principles of operation as opposed to circuit applications. Graduate Staff

ECE (PY) 627 Semiconductor Thin Films Technology. *Preq.: ECE 530. 3(3-0) S. Alt. yrs.* Techniques and processes encountered in the growth and characterization of epitaxial semiconductor films. Examples of growth techniques to be considered are: solution growth, chemical vapor deposition, molecular beam epitaxy and sputtering. Film characterization includes electrical characterization using Hall techniques, optical characterization using x-ray and electron microscopy techniques, surface and thin film analysis such as auger and secondary ion mass-spectrometer. Graduate Staff

ECE 632 Power System Stability and Control. *Preqs.: ECE 451, ECE 516. 3(3-0) S.* Modeling of synchronous machines and their control systems. Coupled electric circuit approach, Park's transformations, additional rotor windings. Rudiments of dynamic and transient stability. Excitation systems, governor-control systems, power-system stabilizers. State space formulations for computer-based dynamic studies. Graduate Staff

ECE 633 Computer Analysis of Large-Scale Power Systems. *Preq.: ECE 550. 3(3-0) F.* Computer-based matrix methods of analysis of large networks. Problem statements, algorithmic formulations and solution techniques emphasizing efficient use of the computer for short-circuit calculations, computations of power flows under normal and emergency conditions and stability studies. Linear programming and optimization methods in power system planning. Graduate Staff

ECE (CSE) 640 Advanced Logic Systems. *Preq.: ECE (CSE) 520. 3(3-0) S.* A study of state-of-the-art concepts in the area of digital systems. The theoretical and technological results and trends as indicated by the current literature will be studied. This course is intended to provide understanding of current advanced concepts as well as provide research background. Graduate Staff

ECE (CSE) 641 Sequential Machines. *Preq.: ECE (CSE) 520. 3(3-0) F.* The study of finite automata, both synchronous and asynchronous. Machine equivalence and minimization, state identification and the state assignment problem. Flip-flop activation from the state diagram and other realization techniques. Graduate Staff

ECE 642 Automata and Adaptive Systems. *Preq.: ECE (CSE) 520. 3(3-0) S.* The study of neural nets in natural systems, artificial nerve nets, artificial intelligence, goal-directed behavior, the logic of automata and adaptive Boolean logic. Computability, Turing machines and recursive function theory. Graduate Staff

ECE (CSE) 651 Statistical Communication Theory. *Preq.: ECE (CSE) 514 or MA (ST) 541. 3(3-0) S.* Waveform analysis including Fourier transforms, correlation functions and other statistical descriptions of stationary and non-stationary random processes. Weiner theory: prediction, estimation and smoothing of discrete and continuous signals; introduction to Kalman filtering; problems to illustrate the applications of the theory to speech, television and data communication systems. Graduate Staff

ECE (CSE) 652 Information Theory. *Preq.: ECE (CSE) 514. 3(3-0) F.* Definition of a measure of information and a study of its properties, information sources and their efficient representation, communication channels and their capacity, encoding and decoding of data for transmission over noisy channels, source encoding systems, error correcting codes, rate distortion bounds. (Offered alt. years.) Graduate Staff

ECE 659 Structural Pattern Recognition. *Preq.: ECE 559. 3(3-0) F.* Analysis of images by computers. Specific attention is given to analysis of the geometric features of objects in images, such as region size, connectedness and topology. Topics covered include: segmentation, template matching, motion analysis, boundary detection, region growing, shape representation, representation and process of three-dimensional structures. Snyder

ECE (CSC, CSE) 671 Computer Systems Performance Evaluation. 3(3-0) S. Alt. yrs. (See computer studies.)

ECE 691, 692 Special Studies in Electrical Engineering. 3(3-0) F,S. An opportunity for small groups of advanced graduate students to study topics in their special fields of interest under the direction of members of the graduate faculty. Graduate Staff

ECE 693 Individual Studies in Electrical Engineering. *Preq.: Grad. standing. 1-3 F,S.* The study of advanced topics of special interest to individual students under the direction of faculty members. Graduate Staff

ECE 695 Electrical Engineering Seminar. *Preq.: Grad. standing in ECE. 1(1-0) F,S.* A series of papers and conferences participated in by the instructional staff, invited guests and students who are candidates for advanced degrees. Graduate Staff

ECE 698 Electrical Engineering Design Project. *Preq.: Grad. standing in ECE. 3-6 F,S.* A course in which a student, or a group of students working as a team, will design and usually build, test, and evaluate an electrical device, system, or process. A written engineering report is required. The oral examination of a candidate for the degree of Master of Electrical Engineering will include questioning on this course. Graduate Staff

ECE 699 Electrical Engineering Research. *Preqs.: Grad. standing in ECE, consent of advisor. Credits arranged.* Graduate Staff

Engineering

These courses are designed for use by graduate students in any department in the School of Engineering.

E (MA, OR) 531 Dynamical Systems and Multivariable Control. 3(3-0) F. (See operations research.)

E (OR) 650 Algorithmic Methods in Optimal Control. 3(3-0) S. Alt. yrs. (See operations research.)

English

GRADUATE FACULTY

Professor J. E. Bassett, Head

Professor J. D. Durant, Associate Head

Professor M. C. Williams, Director of the Graduate Program

Professors: B. H. Baines, P. E. Blank Jr., L. S. Champion, M. Halperen, M. T. Hester, A. S. Knowles, L. H. MacKethan, W. E. Meyers, M. S. Reynolds, D. D. Short, J. J. Smoot, A. F. Stein, W. B. Toole III; *Professors Emeriti:* H. G. Kincheloe, B. G. Koonce Jr., F. H. Moore, R. G. Walser, P. Williams Jr.; *Associate Professors:* G. W. Barrax, L. J. Betts Jr., E. D. Clark Sr., J. W. Clark Jr., E. D. Engel, J. Ferster, J. M. Grimwood, H. A. Hargrave, A. H. Harrison, L.

T. Holley, M. F. King, D. L. Laryea, C. R. Miller, C. E. Moore, C. A. Prioli, L. S. Rudner, L. Smith, N. G. Smith, J. N. Wall Jr., H. C. West, R. V. Young Jr.; *Associate Professor Emeritus*: E. P. Dandridge Jr.; *Assistant Professors*: D. H. Covington, J. J. Kessel, C. W. Pollard

The Department of English offers instruction leading to the Master of Arts degree in English and American literature and language. The program is designed either to provide the student with a terminal course of study or to serve as the first year toward a doctorate. A minimum of 30 semester hours of graduate credit is required, though the program may be expanded to meet the needs of individual students.

A student may choose a 37-hour program which includes a concentration in composition consisting of four courses in rhetoric, linguistics and the teaching of composition.

The student who holds "A" certification from the N. C. Department of Public Instruction may pursue a Master of Arts with Graduate Certification. This program involves a minimum of 30 semester hours of graduate credit in English and 9 semester hours of graduate credit in education.

The student who holds "A" certification may also pursue advanced or sixth-year certification, a program requiring 21 to 60 semester hours of graduate study of English, education and elective courses, depending upon the level of preparation brought to the program.

Assistantships for promising students are available. These students will take ENG 504 in the fall semester and, under supervision, devote half time in subsequent semesters to the teaching of courses in freshman composition.

North Carolina State University is a member of the Folger Institute of Renaissance and Eighteenth-Century Studies, a unique collaborative enterprise sponsored by the Folger Shakespeare Library in Washington, D.C., and twenty universities in the Middle Atlantic region. Each year the Institute offers an interdisciplinary program in the humanities—seminars, workshops, symposia, colloquia and lectures. Admission is open to faculty and students of North Carolina State University, and a limited number of fellowships are available through the Campus Folger Institute Committee.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

NOTE: The prerequisite for all 500-level English courses is upper division or graduate standing.

ENG 504 Problems in College Composition. *Preq.: Grad. standing. 3(3-0) F.* Study of the history and theory of rhetoric; practice in writing and in literary analysis; preparation for the profession of teaching composition and literature. Required of all teaching assistants in English. Grimwood, MacKethan

ENG 548 Black American Literature. *3(3-0) F.* Survey of black American literature and its relationships to culture from its beginnings to the present. Representative works from the oral tradition, slave narratives, Washington-DuBois controversy and the Harlem Renaissance. Writers include Douglass, Washington, Dunbar, Chesnutt, DuBois, Johnson, Hughes, Toomer, Hurston, Wright and several more recent figures. Laryea, MacKethan

ENG 561 Milton. 3(3-0) S. An intensive reading of Milton with attention to background materials in the history and culture of seventeenth-century England. Wall, Young

ENG 575 Southern Writers. 3(3-0) S. A survey of the particular contribution of the South to American literature, with intensive study of selected major figures.
Grimwood, Laryea, MacKethan

ENG 578 English Drama to 1642. *Preqs.: ENG 261 and upper division or grad. standing.* 3(3-0) F. *Alt. yrs.* Study of English drama from its beginnings in cycle plays to the closing of the theaters. Emphasis is placed on Elizabethan and Jacobean drama, excluding Shakespeare. Baines, Williams

ENG 579 Restoration and 18th-Century Drama. 3(3-0) S. *Alt. yrs.* Intensive study of the English drama from 1660 to 1800. Durant

ENG 590 Literary Criticism. 3(3-0) S. *Alt. yrs.* An examination of the critical process as it leads to the definition and analysis of literature, together with attention to the main literary traditions and conventions. Ferster, Holley

FOR GRADUATES ONLY

NOTE: The prerequisite for all 600-level English courses is graduate standing unless additional prerequisites are noted.

ENG 609 Old English Literature. 3(3-0) S. *Alt. yrs.* An introduction to the language and literature of the Old English period (450-1100). Readings will be in the original and will include both poetry and prose. Ferster, Short

ENG 610 Middle English Literature. 3(3-0) S. *Alt. yrs.* A study of major works of medieval English literature (exclusive of Chaucer) in the light of dominant intellectual and artistic traditions: emphasis is on four works: *Piers Plowman*, *Pearl*, *Sir Gawain and the Green Knight*, and Malory's *Morte d'Arthur*. Ferster, Holley

ENG 615 American Colonial Literature. 3(3-0) S. *Alt. yrs.* A study of American literature and thought from the beginning to the adoption of the Constitution. J. Clark, Prioli

ENG 620 16th-Century Non-Dramatic English Literature. 3(3-0) F. A detailed survey of non-dramatic prose and verse of the sixteenth century against the background of Humanism with the consequent assimilation of classical and continental literary subjects and forms. Blank, Hester, Wall

ENG 622 The Rhetoric of Written Discourse. 3(3-0) S. Contemporary rhetorical theory and its development from classical rhetoric; emphasis on the differences between oral and written communication and the relevance of traditional theory to the purposes and constraints of writing. Special attention to current issues: the revival of invention, argumentation and truth, contributions of research in composition. C. Miller

ENG 624 Modern English Usage. 3(3-0) F. *Alt. yrs.* An intensive study of English grammar, with attention to new developments in structural linguistics and with emphasis on current usage. Meyers, Short

ENG 626 History of the English Language. 3(3-0) F. *Alt. yrs.* A survey of the growth and development of the language from its Indo-European beginnings to the present. Meyers, Short

ENG 630 17th-Century English Literature. 3(3-0) S. A close examination of the literature of England from 1600 to 1700 with emphasis on major literary figures and movements, the

development of important literary forms and genres, and the intimate relationship between the literature of this period and its philosophical, political and theological backgrounds.

Hester, Wall, Young

ENG 650 English Romantic Period. *3(3-0) F.* A detailed study of the six major romantic poets—Blake, Wordsworth, Coleridge, Byron, Shelley, and Keats; some attention as well to the political, social and literary background and to a few minor writers and critics.

Hargrave, Harrison

ENG 651 Chaucer. *Preqs.: ENG 451 or equivalent and grad. standing. 3(3-0) F.* An intensive study of the Chaucer canon requiring independent research.

Ferster, Holley, Meyers

ENG 655 American Romantic Period. *3(3-0) F.* A study of the selected works of Poe, Hawthorne, Melville, Emerson, and Thoreau, with emphasis on their varied contributions to the literature and thought of the American romantic movement.

Bassett, MacKethan, Stein, West

ENG 658 Studies in Shakespeare. *Preqs.: ENG 486 or ENG 487 or equivalent and grad. standing. 3(3-0) F,S.* An intensive study of a particular phase of the Shakespeare canon. Emphasis will normally be on one dramatic genre (tragedy, comedy, history), but occasionally the focus may be more limited. Students may register for credit for a maximum of six hours.

Baines, Champion, Williams

ENG 660 Victorian Poetry and Critical Prose. *3(3-0) S.* Studies in the literature of Victorian England: 1837-1901; the major poets and essayists, movements and questions in their historical contexts, religious, political and aesthetic.

Hargrave, Harrison, King

ENG 662 18th-Century English Literature. *3(3-0) F.* The major figures in English literature between 1660 and 1790 against the background of social, cultural and religious change.

Durant, Moore

ENG 663 18th-Century English Novel. *3(3-0) S. Alt. yrs.* Selected British novels of the eighteenth century studied in relation to the history and development of the genre and in the light of available critical opinion past and present.

Durant, Moore

ENG 664 Victorian Novel. *3(3-0) F. Alt. yrs.* The nineteenth-century British novel studied from the perspective of literary history and twentieth-century criticism.

Engel, King

ENG 665 American Realism and Naturalism. *3(3-0) S.* Concentration on Whitman, Dickinson, Twain, James and Dreiser, with briefer attention to Howells, Crane, Norris and other realists and naturalists.

Bassett, MacKethan, Stein, West

ENG 670 20th-Century British Prose. *3(3-0) F. Alt. yrs.* An examination of the works of the major British writers and literary movements of this century and their historical context, religious, political and aesthetic.

Halperen, Knowles, Reynolds

ENG 671 20th-Century British Poetry. *3(3-0) S. Alt. yrs.* The development of English poetry from the rebellion against Victorian and Pre-Raphaelite verse to the present post-war scene; special attention to Hardy, Yeats, Eliot, Auden and Thomas.

Halperen, Knowles, Reynolds

ENG 675 20th-Century American Prose. *3(3-0) F. Alt. yrs.* An examination of representative American writers of the novel and short fiction.

Bassett, Halperen, Knowles, Reynolds

ENG 676 20th-Century American Poetry. 3(3-0) *S. Alt. yrs.* The development of modern American poetry from the rebellion against the romantic and genteel verse of the 1890's; special attention to Robinson, Frost, Pound, Williams, Stevens and Ransom.

Bassett, Halperen, Knowles, Reynolds

ENG 680 20th-Century British Drama. 3(3-0) *F. Alt. yrs.* A survey of modern British drama from its beginnings at the turn of the century to the present.

Halperen, Knowles

ENG 681 20th-Century American Drama. 3(3-0) *F. Alt. yrs.* A survey of modern American drama centering on major figures.

Halperen, Knowles

ENG 691 Special Topics in Written Communication. *Preq.: One 200-level writing course.* 3(3-0) *S.* Intensive study of issues in written communication, with special emphasis on application of theory to problems in a variety of areas. Seminar discussions and independent research.

C. Miller

ENG 692 Special Topics in American Literature. *Preq.: Consent of seminar chairman.* 3(3-0) *F,S.* An intensive study, involving independent research and centering on some limited topics from American literature.

Graduate Staff

ENG 693 Special Topics in English Literature. *Preq.: Consent of seminar chairman.* 3(3-0) *F,S.* An intensive study, involving independent research and centering on some limited topic from English literature.

Graduate Staff

ENG 698 Bibliography and Methodology. 1-3. Intensive study of the bibliography and methodology of literary research. Required of all graduate students in English.

Graduate Staff

ENG 699 Research in Literature (Thesis). *Preq.: Consent of graduate adviser. Credits Arranged.* *F,S.* Independent investigation of an advanced literary or linguistic problem leading to the writing of a master's thesis.

Thesis Director

Entomology

GRADUATE FACULTY

Professor R. J. Kuhr, *Head*

Professors: R. C. Axtell, J. R. Bradley Jr., W. M. Brooks, W. V. Campbell, W. C. Dauterman, M. H. Farrier, F. E. Guthrie, F. P. Hain, E. Hodgson, G. G. Kennedy, H. B. Moore Jr., H. H. Neunzig, G. C. Rock, T. J. Sheets, K. A. Sorensen, R. E. Stinner, J. W. Van Duyn, C. G. Wright; *Adjunct Professors:* J. R. Bend, A. L. Chasson, J. R. Fouts, F. L. Hastings, R. A. Neal, R. M. Philpot; *Professors Emeriti:* K. L. Knight, W. J. Mistic Jr., R. L. Rabb, R. L. Robertson, C. F. Smith, D. A. Young Jr.; *Associate Professors:* J. T. Ambrose, C. S. Apperson, J. S. Bacheler, J. R. Baker, F. L. Gould, R. C. Hillmann, J. R. Meyer, B. M. Parker, P. S. Southern; *Adjunct Associate Professors:* C. Y. Kawanishi, H. B. Matthews Jr.; *Assistant Professors:* J. J. Arends, R. L. Brandenburg, L. L. Dietz, G. J. House, E. P. Lampert, R. M. Roe; *Adjunct Assistant Professor:* K. G. Wilson

ASSOCIATE MEMBERS OF THE DEPARTMENT

Associate Professor: B. C. Haning; *Assistant Professor:* H. M. Linker

The Department of Entomology* offers graduate training leading to the Master of Science, Master of Agriculture (non-thesis) and Doctor of Philosophy degrees. Major areas of specialization are acarology, agricultural entomology, apiculture, behavior, ecology, forest entomology, host-plant resistance, invertebrate pathology, medical and veterinary entomology, nutrition, pesticide analysis, pesticide fate in soil and water, pest management, physiology, population dynamics, soil entomology, systems analysis, taxonomy and toxicology.

Opportunities exist for training in both applied and fundamental phases of entomology. Population management concepts are emphasized in the applied entomology and pest management programs. The applied phases are influenced by the State's agriculture, in which corn, tobacco, cotton, peanuts, soybeans, small grains, fruits, vegetables, livestock and forestry are important components. The rapidly expanding tourist industry and the diverse habitats of the State, extending from the mountains to the sea, provide unique opportunities for research on insects and related arthropods affecting man. A cooperative arrangement with the School of Forest Resources provides majors in forest entomology. The program in medical and veterinary entomology includes both applied and fundamental research and provides the opportunity for training at the School of Public Health, UNC, Chapel Hill. Students electing graduate work in entomology are expected to have strong backgrounds in biological sciences, chemistry and mathematics. Undergraduate preparation in entomology is not required.

Strong interdepartmental programs in ecology, physiology and toxicology include faculty members from the Department of Entomology and provide graduate training for entomology students desiring interdisciplinary graduate degrees. Additionally, interinstitutional courses are available on the nearby campuses of Duke University and the University of North Carolina at Chapel Hill. The presence of numerous federal and industry laboratories in the nearby Research Triangle Park further enhances entomology graduate training.

The departmental research, extension and training programs are housed in a complex of facilities including a pesticide residue research laboratory, biochemistry and toxicology laboratories, insect rearing rooms, greenhouses and field stations. An adjacent phytotron or bioclimatic facility provides an opportunity for ecological and behavioral studies under controlled conditions. Ultrastructural investigations are conducted in the electron microscope facility of the School of Agriculture and Life Sciences. Extensive computer facilities and statistical services are available in the department and on campus.

See a description of the Pesticide Residue Research Laboratory elsewhere in this bulletin.

SELECTED ADVANCED UNDERGRADUATE COURSES

ENT (ZO) 425 General Entomology. *Preq.: ZO 201 or equivalent. 3(2-3) F,Sum.*

Related Course:

PM 415 Principles of Pest Management. *Preqs.: BO (ZO) 360, PP 315, ENT 312; Coreq.: CS 414. 4(3-3) S.*

*This department does require GRE scores.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ENT 502 Insect Diversity. *Preq.: ENT 425 or equivalent. 4(2-4) F.* Surveys the diversity of insect biology and structure emphasizing the identification of adults; includes speciation, evolutionary relationships, approaches to classification, nomenclature, zoogeography and techniques of collection. Deitz

ENT 503 Functional Systems of Insects. *Preqs.: Twelve hours of biology, nine hours of CH. 4(3-3) S.* The morphology, histology and function of the organ systems of insects. Basic physiological principles are discussed in the context of insect growth and development. The laboratory is designed to give students practical experience with modern physiological techniques. Roe

ENT (ZO) 509 Ecology of Stream Invertebrates. *4(2-6) S.* (See zoology.)

ENT 520 Insect Pathology. *Preqs.: ENT 425 and MB 401 or equivalent. 3(2-3) S. Alt. yrs.* A treatment of the noninfectious and infectious diseases of insects, the etiological agents and infectious processes involved, immunological responses and applications. (Offered S. 1987 and alt. years.) Brooks

ENT (BO, CS, PM, PP) 525 Biological Control. *4(3-3) F. Alt. yrs.* (See pest management.)

ENT 531 Insect Ecology. *Preqs.: ENT 425 and BO (ZO) 560 or equivalent. 3(2-2) F. Alt. yrs.* The interrelationships among insects and components of their effective environments which result in dynamic spatial and temporal patterns of particular species. Also, the diverse roles of insects in the structure and function of communities and ecosystems. (Offered F 1986 and alt. years.) Gould

ENT 541 Immature Insects. *Preq.: ENT 502 or equivalent. 3(1-4) F. Alt. yrs.* Biology and taxonomy of immature insects with emphasis on identification of the larval stage of holometabolous orders. A collection of immatures and associated reared adults is required. (Offered F 1986 and alt. years.) Neunzig

ENT 542 Acarology. *Preq.: ENT 301 or 312 or ZO 201. 3(2-3) S. Alt. yrs.* A systematic survey of the mites and ticks with emphasis on identification, biology and control of the more common and economic forms attacking material, plants and animals including man. Farrier

ENT 550 Fundamentals of Insect Control. *Preq.: ENT 312 or 301. 3(2-2) F.* The principles underlying modern methods for protecting food, clothing, shelter and health from insect attack. Guthrie

ENT 562 Insect Pest Management in Agricultural Crops. *Preq.: ENT 550. 3(3-0) S. Alt. yrs.* Critical review of the biology and ecology of representative beneficial and injurious insects and arachnids of agricultural crops and the advantages and limitations of advanced concepts of their management in selected agroecosystems. (Offered S 1987 and alt. yrs.) Bradley, Kennedy, Rock

ENT (FOR) 565 Advanced Forest Entomology. *Preq.: ENT 301 or ENT 502 or CI. 3(2-2) S. Alt. yrs.* Covers the important insect pests of forest and shade trees including regeneration pests, defoliating insects, inner-bark borers, wood borers, sucking insects, and bud, twig and root feeding insects. Also includes concepts in forest pest management and population dynamics. (Offered S 1986 and alt. years.) Hain

ENT (ZO) 582 Medical and Veterinary Entomology. *Preqs.: ENT 312 or 425 and ZO 315 or equivalent. 3(2-3) S. Alt. yrs.* The morphology, taxonomy, biology and control of the arthropod parasites and disease vectors of man and animals. The ecology and behavior of vectors in relation to disease transmission and control. (Offered S 1986 and alt. years.)

Axtell

ENT 590 Special Problems. *Preq.: CI. Credits Arranged. F,S.* Original research on special problems in entomology not related to a thesis problem. Provides experience and training in research.

Graduate Staff

ENT 592 Agricultural Entomology Practicum. *Preq.: Economic entomology (ENT 562 recommended). 3(0-9) Sum. Alt. yrs.* Practical experience in research, extension and commercial aspects of insect pest management on a broad range of agricultural crops under actual field conditions. Class meets 9 hours each Friday for 10 weeks from early June to mid August. Students should register for second summer session. (Offered Sum. 1987 and alt. years.)

Bradley

FOR GRADUATES ONLY

ENT 622 Insect Toxicology. *Preqs.: ENT 550, BCH 551 or equivalent. 3(2-3) S. Alt. yrs.* The relation of chemical structure to insect toxicity, the mode of action of toxicants used to kill insects, the metabolism of insecticides in plant and animal systems, the selectivity within the cholinesterase inhibitors and other selective mechanisms and the analysis of insecticide residues will be discussed. (Offered S 1986 and alt. years.)

Dauterman, Guthrie

ENT 690 Seminar. *Preq.: Grad. standing in ENT or closely allied fields. 1(1-0) F,S.* Discussion of entomological topics selected and assigned by seminar chairman.

Graduate Staff

ENT 699 Research. *Preq.: Grad. standing. Credits Arranged. F,S.* Original research in connection with thesis problem in entomology.

Graduate Staff

Fiber and Polymer Science

ASSOCIATED GRADUATE FACULTY

Professors: S. K. Batra, D. R. Buchanan, D. M. Cates, J. A. Cuculo, A. H. M. El-Shiekh, R. E. Fornes, T. W. George, R. D. Gilbert, P. L. Grady, B. S. Gupta, D. S. Hamby, S. P. Hersh, H. B. Hopfenberg, C. D. Livengood, P. R. Lord, R. McGregor, M. H. M. Mohamed, H. G. Olf, V. T. Stannett, W. C. Stuckey Jr., M. H. Theil, C. Tomasino, P. A. Tucker, W. K. Walsh, C. F. Zorowski; *Adjunct Professors:* J. E. Hendrix, H. F. Mark, A. A. Volpe; *Professors Emeriti:* J. F. Bogdan, D. W. Chaney, H. A. Rutherford, W. M. Whaley, R. W. Work; *Associate Professors:* R. L. Baker, T. J. Little, G. N. Mock, C. B. Smith; *Associate Professors Emeriti:* T. H. Guion, T. G. Rochow

Fiber and polymer science is a multidisciplinary program bringing together the disciplines of mathematics, chemistry and physics and the application of engineering principles for the development of independent scholars versed in the field of fiber materials science. The program is administered by the School of Textiles and leads to the degree of Doctor of Philosophy. Students majoring in the physical sciences, mathematics, textiles or engineering and having at least a "B" grade in their undergraduate major will normally qualify for admission.

Fiber and polymer science is concerned with polymeric materials, fibers produced from them, fiber assemblies in one-, two- and three-dimensional forms and chemical modification of fiber assemblies. This broad field of study permits a wide range of useful concentrations. The candidate is expected to penetrate deeply into one area of specialization and to acquire a reasonable perspective in other relevant subject matter. Generally specialization occurs within the area of (1) polymer chemistry and synthesis, (2) fiber and polymer physics and physical chemistry, (3) structural mechanics of textile materials or (4) dyeing and chemical modification of textile materials. The student's research is based within one of these areas.

Ample laboratory space is available and there are a number of specialized laboratories equipped to support doctoral investigations. Other facilities and research equipment which may be used in fiber and polymer science research programs are available in cooperating departments on campus. The Burlington Textiles Library houses one of the most complete collections of polymer, fiber and textile literature.

DEGREE REQUIREMENTS

Doctor of Philosophy—An advisory committee chaired by a member of the fiber and polymer science faculty is formed as soon as possible to develop with the student a plan of study designed to enable one to acquire the comprehensive knowledge required to pass the qualifying cumulative examinations.

There are no definite requirements in credit hours for the Doctor of Philosophy degree. A student's program of study is designed around the student's special interests, while maintaining the coherence and breadth essential for professional development and excellence in research. A reading knowledge of one foreign language is required.

Doctor of Philosophy Minor—Ph.D. candidates who designate a named minor in fiber and polymer science will be required to take nine credit hours in related courses approved by the minor representative on the student's advisory committee.

Communications concerning this program should be directed to the Chairman of the Committee for the Fiber and Polymer Science Program, School of Textiles, North Carolina State University.

COURSE OFFERINGS*

(See departmental listing for descriptions.)

GENERAL COURSES

T 402 Introduction to the Theory and Practice of Fiber Formation.

TC (CH) 461 Introduction to Fiber-Forming Polymers.

TC 504 Fiber Formation—Theory and Practice.

TC (CH) 562 Physical Chemistry of High Polymers—Bulk Properties.

*Extensive use may be made of graduate course offerings in other schools on campus when developing the minor field.

TX 561 Mechanical and Rheological Properties of Fibrous Material.

TX 563 Characterization of Structure of Fiber Forming Polymers.

TC 591 Special Topics in Textile Science.

COURSES IN AREAS OF SPECIALIZATION

Polymer Chemistry and Synthesis

TC 520 Chemistry of Dyes and Color.

TC 521 Dye Synthesis Laboratory.

TC 530 The Chemistry of Textile Auxiliaries.

TC 561 Organic Chemistry of High Polymers.

TC (CHE) 671 Special Topics in Polymer Science.

Polymer Physics and Physical Chemistry

T 500 Fiber and Polymer Microscopy.

TC 504 Fiber Formation—Theory and Practice.

TC 505 Theory of Dyeing.

TC (CH) 562 Physical Chemistry of High Polymers—Bulk Properties.

TC 662 Physical Chemistry of High Polymers—Solution Properties.

TC (CHE) 569 Polymers, Surfactants and Colloidal Materials.

TC (CHE) 570 Radiation Chemistry and Technology of Polymeric Systems.

TC (CHE) 669 Diffusion in Polymers.

TX 562 Physical Properties of Fiber Forming Polymers, Fibers and Fibrous Structures.

TX (TC) 691 Special Topics in Fiber Science.

Mechanics of Textile Materials and Processes

TX 520 Yarn Processing Dynamics.

TX 549 Warp Knit Engineering and Structural Design.

TX 555 Production Mechanics and Properties of Woven Fabrics.

TX 640 Physical and Mechanical Properties of Knitted Fabrics.

TX 663 Mechanics of Twisted Structures.

TX 664 Mechanics of Fabric Structures.

Food Science

GRADUATE FACULTY

Professor D. R. Lineback, Head

Professor V. A. Jones, Graduate Administrator

Professors: L. W. Aurand, H. R. Ball Jr., D. E. Carroll Jr., H. B. Craig, D. D. Hamann, H. N. Jacobson, H. E. Swaisgood, C. T. Young; *Extension Professors:* F. R. Tarver Jr., F. B. Thomas; *Professors (USDA):* H. P. Fleming, W. M. Walter Jr.; *Adjunct Professor:* R. A. Neal; *Professors Emeriti:* T. A. Bell, T. N. Blumer, E. S. Cofer, M. W. Hoover, I. D. Jones, W. M. Roberts, M. L. Speck, F. G. Warren; *Associate Professors:* G. L. Catignani, A. P. Hansen, H. M. Hassan, T. R. Klaenhammer, T. C. Lanier, K. R. Swartzel, L. G. Turner; *Associate Professor (USDA):* R. F. McFeeters; *Assistant Professors:* E. A. Foegeding, P. M. Foegeding, J. T. Keeton, S. J. Schwartz, B. W. Sheldon; *Assistant Professor (USDA):* M. A. Daeschel

Programs of study leading to the Master of Agriculture, Master of Life Sciences, Master of Science and Doctor of Philosophy degrees are offered by the Department of Food Science.

Areas of study and research include food chemistry, food microbiology, food engineering, nutrition and food process and product development. These areas involve all foods including dairy products, fruits, meats, poultry products, seafood, nutmeats and vegetables. Supporting course work and cooperative research are offered in areas such as biochemistry, chemistry, economics, engineering, genetics, microbiology, nutrition, toxicology, biotechnology and statistics.

Because of the diversity of disciplines and wide range of opportunities in food science, each student and his advisory committee are granted considerable flexibility in developing a graduate program tailored to the student's interests and research needs. Each program must conform to guidelines of the Graduate School (see Graduate Programs) and food science policies and procedures (available from the Department of Food Science). All graduate students are eligible for assignment as laboratory assistants in food science courses. The Master of Science program requires a minimum of 30 semester hours of work including a thesis. The Master of Agriculture and Master of Life Sciences programs require a minimum of 36 semester hours; no thesis is required, but at least four semester hours of special problems are required. There are no requirements for 600-level courses in the Master of Agriculture and Master of Life Sciences programs. The total semester hours of work for the Ph.D. degree are established by the advisory committee to meet the objectives of the student's program. No foreign language is required.

The department participates in interdepartmental graduate student training programs such as marine science, toxicology, biotechnology and nutrition.

Excellent laboratory, pilot plant, library and computer facilities, as well as graduate assistantships, are available to support qualified candidates.

SELECTED ADVANCED UNDERGRADUATE COURSES

FS 400 Foods and Nutrition. *Preq.: CH 220. 3(3-0) F.*

FS 402 Food Chemistry. *Preq.: CH 220 or CH 221. 3(2-3) F.*

FS (MB) 405 Food Microbiology. *Preq.: MB 401. 3(2-3) F.*

FS 416 Quality Control of Food Products. *Preqs.: FS 402, MB 401. 3(2-3) S.*

FS 421 Food Preservation. *Coreq.: MB 401. 3(2-3) F.*

FS 423 Muscle Food Technology. *Preqs.: FS 322, FS 421, FS 402. 3(2-3) S.*

FS 425 Processing Dairy Products. *Preqs.: FS 324, FS 421. 3(2-3) S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

FS 504 Food Proteins and Enzymes. *Preq.: FS 402 or BCH 451. 3(2-3) F. Alt. yrs.* An advanced course in food chemistry with emphasis on proteins and enzymes of particular importance to foods. Protein interactions and their effect on the physical-chemical characteristics of a product will be discussed. Particular emphasis will be given to the preparation and kinetic properties of immobilized enzymes and their use as biochemical reactors in processing operations or as specific electrodes for analytical purposes. Svaisgood

FS (MB) 506 Advanced Food Microbiology. *Preq.: FS (MB) 405 or equivalent. 3(1-6) S.* The interactions of microorganisms in foods and their roles in food spoilage and bioprocessing. Cellular and molecular relationships in bacterial injury, repair and aging resulting from environmental stresses. Bacterial sporulation, germination and physiological properties of bacterial spores. Graduate Staff

FS 511 Food Research and Development. *Preqs.: FS 331, FS 402, FS (MB) 405. 3(2-3) S.* A study of the scientific principles underlying the development of new and improved food products and processes. The study of specific food industry problems by the case method. Special emphasis on the application of research and development principles to meat, poultry and fisheries industries. Lanier

FS (HS) 562 Post-Harvest Physiology. *3(3-0) S.* (See horticultural science.)

FS 580 Food Kinetics. *Preqs.: FS 212, FS 402, FS 405, MA 212 or CI. 3(3-0) F. Alt. yrs.* Basic and applied kinetic principles, development and use of kinetic data of food components, food processing system design, system modeling, system evaluation and storage stability considerations. Graduate Staff

FS (BAE) 585 Food Rheology. *Preqs.: FS 331 or MAE 314. 3(2-3) F. Alt. yrs.* Principles and methods for measuring rheological properties. Theories of elastic, viscous, viscoelastic and viscoplastic behavior and relationships to food texture and commodity damage during harvest, handling and processing. Influence of time, composition and processing. Influence of time, composition and processing on rheological properties. Hamann

FS 591 Special Problems in Food Science. *Preq.: Grad. or sr. standing. Maximum 6. F,S,Sum.* Analysis of scientific, engineering and economic problems of current interest in foods. The problems are designed to provide training and experience in research. Graduate Staff

FOR GRADUATES ONLY

FS 601 Physical Measurements of Biopolymers. *Preqs.: CH 231 or CH 431, FS 504 or BCH 551. 3(2-3) Alt. S.* The theory of methods commonly used to physically characterize biopolymers will be discussed. Interpretation and limitations of measured values of various physical parameters will be stressed. Particular emphasis will be given to the experimental design and interpretation of the data obtained which will yield the maximum amount of information. Swaisgood

FS (NTR) 606 Vitamin Metabolism. *2(2-0) F.* (See nutrition.)

FS 690 Seminar in Food Science. *1(1-0) F,S.* Preparation and presentation of scientific papers, progress reports and research and special topics of interest in foods. Swaisgood

FS 691 Special Research Problems in Food Science. *Credits Arranged. F,S,Sum.* Directed research in a specialized phase of food science designed to provide experience in research methodology and philosophy. Graduate Staff

FS 699 Research in Food Science. *Credits Arranged. F,S,Sum.* Original research preparatory to the thesis for the Master of Science or Doctor of Philosophy degree. Graduate Staff

Foreign Languages and Literatures

GRADUATE FACULTY

Professor J. H. Stewart, Head

Professors: A. A. Gonzalez, J. R. Kelly, M. Paschal, G. G. Smith, E. M. Stack; Professor Emeritus: G. W. Poland; Associate Professors: G. Gonzalez, E. W. Rollins, H. Tucker Jr., M. A. F. Witt; Assistant Professors: A. Malinowski, L. Mykita

The Department of Foreign Languages and Literatures offers courses to assist graduate students in preparing themselves to use modern foreign languages in research and advanced study. These courses are not open to undergraduate students. Students are encouraged particularly to seek useful foreign research related to their thesis or other research in progress.

Certification may be obtained in languages not normally taught by the department with special permission of the Graduate School.

***FLF 401 French for Graduate Students.** *3(3-0) F and as needed in Sum.* Development of basic vocabulary, knowledge of structures and translation techniques necessary to a reading skill. This course is provided to assist graduate students to prepare for the foreign language reading certification. It does not provide instruction in original composition or in speaking. Students will be certified in the language after successfully passing the final examination. (No prerequisite.)

*These courses are designed to be audited and credits do not apply toward advanced degrees.

***FLG 401 German for Graduate Students.** 3(3-0) *F and as needed in Sum.* This course seeks to teach the structures and patterns of the language as used in technical and scholarly writing, with emphasis on the acquisition of a basic vocabulary. Examples will be drawn from a variety of sources to reflect the interest of all students. Completion of the course, including the final examination, will certify the student in the language. (No prerequisite.)

***FLS 401 Spanish for Graduate Students.** 3(3-0) *F and as needed in Sum.* A course designed to teach students to read Spanish as used in scholarly and technical writing. Material will be drawn from various sources reflecting student interest. Students completing the course, including the final examination, will be certified in the language. (No prerequisite.)

Forestry

GRADUATE FACULTY

Professor A. W. Cooper, Head

Professors: E. B. Cowling, C. B. Davey, P. D. Doerr, M. H. Farrier, E. C. Franklin, D. J. Frederick, L. F. Grand, W. L. Hafley, F. P. Hain, A. E. Hassan, D. L. Holley Jr., R. C. Kellison, S. Khorram, L. A. Nelson, R. L. Noble, T. O. Perry, L. C. Saylor, A. L. Sullivan, R. R. Wilkinson, A. G. Wollum II; *Professor (USDA):* D. E. Moreland; *Professors (USFS):* F. E. Bridgwater Jr., G. Namkoong; *Adjunct Professors:* G. F. Dutrow, J. D. Hair, G. H. Hepting, A. Krochmal, L. J. Metz, C. G. Wells; *Professors Emeriti:* J. W. Duffield, J. O. Lammi, W. D. Miller, R. J. Preston, B. J. Zobel; *Associate Professors:* D. A. Adams, H. V. Amerson, R. I. Bruck, J. D. Gregory, J. B. Jett Jr., J. G. Laarman, R. A. Lancia, R. Lea, R. A. Powell, D. H. J. Steensen, R. J. Weir; *Adjunct Associate Professors:* G. L. DeBarr, J. R. Jorgensen, R. W. Stonecypher; *Assistant Professors:* H. L. Allen Jr., L. E. Hinesley, L. J. Frampton Jr., G. D. Kronrad, S. E. McKeand, J. P. Roise; *Assistant Professor (USFS):* J. E. de Steiguer; *Adjunct Assistant Professors:* J. A. Barker, R. G. Campbell, M. S. Greenwood, R. B. McCullough, H. D. Smith; *Research Associate:* W. S. Dvorak

The Department of Forestry offers graduate work leading to the degrees of Master of Forestry, Master of Science and Doctor of Philosophy. Because of the diversity of disciplines and the wide range of opportunities in forestry, each of these degrees allows considerable flexibility in developing programs of graduate study tailored to the student's objectives.

The Master of Forestry is a professional degree designed to broaden and extend knowledge in the scholarly disciplines of forestry. The program emphasizes course work and application of principles. A thesis is not required. Two options are available: one requires 36 hours of course work and the other requires 30 hours plus a special project.

The Master of Science degree emphasizes training and experience in research. This degree typically leads to specialization in one of the disciplines of forestry. Requirements include 30 hours of course work and a thesis.

The Doctor of Philosophy degree is available to students who demonstrate outstanding intellectual capacity and the ability to conduct original research and scholarly work at the highest levels. There is no foreign language requirement and no specific credit hour requirement; however, the student's advisory committee will insist on a rigorous and appropriate program of study and research.

All applicants for graduate study in forestry must take the Graduate Record Examination and submit scores as part of their application. Students not holding an undergraduate degree in forestry may be admitted for graduate study, but they must lengthen their programs to obtain appropriate background courses in forestry.

The department offers graduate instruction in all of the major areas of forestry. The faculty has professional expertise and on-going research in the following areas: biometrics, biotechnology and pine tissue culture, botany, computer applications, ecology, economics, engineering, entomology, environmental impact assessment, forest management, genetics and tree breeding, hydrology and watershed management, international development, landscape architecture, operations research, plant pathology, remote sensing and computer mapping, resource planning and administration, silviculture, soils and fertilization, and wildlife management. Strong supporting departments on campus increase opportunities for broad and thorough training. Relationships with these departments are strengthened by many joint and associate faculty appointments. In addition, an adjunct faculty of 14 distinguished scientists and practitioners working in industry and government are available to serve on student advisory committees.

Facilities for forest biological research include a phytotron, greenhouses and a small experimental nursery. The experimental and production forests of the School total more than 80,000 acres. The Hofman Forest on the Coastal Plain, the Goodwin Forest in the Sandhills, and the Schenck, Hope Valley and Hill Forests in the Piedmont provide a variety of forest types and problems in the management of timber, water, wildlife and recreational resources.

The department has formal research ties with forest industry and public agencies through its four research and development cooperatives (Tree Improvement, Hardwood Research, Forest Fertilization and Central America and Mexico Coniferous Resources), the Small Woodlot Research and Development Program, and the School's Southern Forest Research Center. Much of the department's research is conducted on forest industry lands in the Southeast.

Inquiries concerning graduate study should be directed to the Graduate Administrator, Department of Forestry, Box 8002, North Carolina State University, Raleigh, NC 27695-8002.

SELECTED ADVANCED UNDERGRADUATE COURSES

FOR 401 Forest Hydrology and Watershed Management. *Preqs.: SSC 200. 4(3-3) F.*

FOR (FW) 404 Forest Wildlife Management. *Preqs.: BS 100 or equivalent plus 8 hours of biological sciences; advanced undergrad. or grad. student. 3(3-0) S.*

FOR 405 Forest Management. *Preqs.: FOR 304, 319, ST 312, Summer Camp. 4(2-4) F.*

FOR 406 Forest Inventory, Analysis and Planning. *Preqs.: FOR 273, 353, 405, ST 312, Summer Camp. 4(0-16) S.*

FOR 411 Forest Tree Improvement. *Preq.: Jr. or sr. standing in FOR. 3(3-0) S.*

FOR 412 Forest Types of the Southeast. *Preq.: FOR 212. 2(1-3) S.*

FOR 422 Consulting Forestry. *Preq.: Sr. standing in forestry. 3(3-0) F.*

FOR (WPS) 423 Mechanization of Silvicultural Operations. *Preqs.: MA 113, MA 114, PY 221, jr. standing. 3(2-3) F.*

FOR (WPS) 434 Quantitative Methods of Decision Making in Forest Products. *Preqs.: FOR (WPS) 273, MA 113 and 114. 3(3-0) F.*

FOR 472 Renewable Resource Policy and Management. *Preq.: Jr. standing. 4(3-3) S.*

FOR 491 Senior Problems in Forestry. *Preq.: Consent of department. 1-6.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

FOR 511 Tree Improvement Research Techniques. *Preq.: FOR 411 or GN 411. 3(1-4) S. Alt. yrs.* Research methods involved in forest tree breeding and genetics programs. Emphasis is placed on laboratory, greenhouse and field research techniques. Summary and presentation of research results are also stressed. Jett, Zobel

FOR 512 Forest Economics. *Preq.: Basic course in economics. 3(3-0) S.* Economics and social value of forests; supply of and demands for forest products; land use; forestry as a private and a public enterprise; economics of the forest industries. Holley, Laarman

FOR (PP) 518 Advanced Forest Pathology. *3(3-0) Alt. F.* (See plant pathology.)

FOR (PA) 522 Natural Resources Policy and Administration. *3(3-0) S.* (See political science and public administration.)

FOR (ENT) 565 Advanced Forest Entomology. *3(2-2) S.* (See entomology.)

FOR 571 Advanced Topics in Growth and Yield. *Preqs.: FOR 272, ST 312. 3(3-0) S.* Development and application of site index, volume and forest yield models. Primary emphasis is on underlying biological and mensurational assumptions and their impact on application. Hafley

FOR 572 Public Forest and Renewable Resource Issues. *3(3-0) S.* Current topics in public resource management policy. Special attention is directed to forest resources policies and state and federal management and regulatory programs affecting the use of renewable resources. The role of professional foresters and related specialists is stressed. Cooper

FOR (UNI) 584 The Practice of Environmental Impact Assessment. *4(0-8) F.* Students (in teams) inventory natural resources in a large watershed, predict development at year 2000, analyze impact upon the natural resource base and compile results as an environmental impact assessment. Techniques include map and aerial photo interpretation, timber and wildlife habitat inventory, erosion estimation, curve fitting, technical writing, computer modeling and project organization and management. Adams

FOR (FW) 585 Advanced Wildlife Habitat Management. *Preqs.: ZO (FW) 553 and ZO (FW) 554. 3(2-3) S. Alt. yrs.* Assessing and modeling habitat capability for wildlife species are discussed and evaluated. Students will develop models of habitat requirements for wildlife species and will integrate the models into wildlife management plans. Laboratory exercises include manipulation of habitat management computer packages and development of a wildlife management plan using computer cartographic techniques. Lancia

FOR 591 Forestry Problems. *Preq.: Advanced undergrad. or grad. standing. Credits Arranged. F,S,Sum.* Assigned or selected problems in the field of silviculture, harvesting operations, lumber manufacturing, policy, wood science, pulp and paper science, wood chemistry or forest management. Graduate Staff

FOR 599 Methods of Research in Forestry. *Preq.: Advanced undergrad. or grad. standing. Credits Arranged. F,S,Sum.* Research procedures, problem analysis, working plan preparation, interpretation and presentation of results; evaluation of selected studies by forest research organizations; techniques and constraints in the use of sample plots. Graduate Staff

FOR GRADUATES ONLY

FOR 601 Advanced Hydrology. *Preqs.: FOR 401, ST 512. 3(3-0) S. Alt. yrs.* The physical concepts of water movement through the hydrologic cycle and interactions with ecosystem components are discussed. Mathematical approaches to characterizing and quantifying hydrologic processes are derived and applied to problem solutions. Experimental design and statistics needed for collecting and analyzing hydrologic data are discussed and utilized. Development and use of simulation models are considered. Gregory

FOR (GN) 611 Forest Genetics. *Preq.: GN 411 or CI. 3(3-0) S.* Application of genetic principles to silviculture, management and wood utilization. Emphasis is on variation in wild populations, the bases for selection of desirable qualities and fundamentals of controlled breeding. Saylor, Zobel

FOR (GN) 612 Advanced Topics in Quantitative Genetics. *Preqs.: GN (FOR) 611, GN (ST) 626 or GN (ANS) 603 or CI. 3(3-0) F. Alt. yrs.* Advanced topics in statistics and population genetics pertinent to current research problems in genetics with special applications to forestry. Basic statistical and genetic theory is reviewed as bases for intensive study of selection theory and experimental and mating design evaluation. The genetics of natural populations are studied for evolutionary interest as well as for their implications to breeding theory. Namkoong

FOR 613 Special Topics in Silviculture. *Preq.: One course in silviculture or CI. 3(2-1) F.* Critical examination of selected topics, with special emphasis on concepts and phenomena which distinguish forests from other biotic communities and silviculture from other fields of applied biology. Frederick

FOR 614 Advanced Topics in Administration of Forest Resources. *Preq.: FOR 613 or CI. 3(3-0) S.* The state-of-the-art practices for administering commercial forest lands are explicitly detailed for advanced forestry graduate students. The economics of intensive and extensive management, the effect of management policies on timber yields and the financial stability of the forest industry are set forth, using governmental and industrial perspectives. Manuscripts suitable for publication will comprise 25% of the grade. Kellison, Lea

FOR (PA) 620 Environmental Administration. *3(3-0) S.* (See political science and public administration.)

FOR (SSC) 673 Advanced Forest Soils. *Preqs.: Two of SSC 511, SSC 522, SSC 532, SSC 551. 3(2-3) S. Alt. yrs.* An advanced consideration of the unique properties of forest soils and

their relationships to the productivity and manageability of forest sites. The processes and dynamics of the nutrient cycle in forest ecosystems are covered in depth and used as a basis for understanding the impacts of silvicultural practices on forest site values. Individual field/laboratory projects are required. Allen

FOR 689 Seminar in Forest Research. *Preq.: Grad. standing. 1(1-0) F.* Philosophy and objectives of scientific research and the steps in the research process. Basic and applied research, inductive and deductive reasoning and the need for hypothesis development and testing as a basis for scientific research. Special emphasis on the preparation of study plans, graduate theses, published articles and technical presentations.

Franklin, Graduate Staff

FOR 691 Graduate Seminar. *Preq.: Grad. standing. 1(1-0) F,S.* Presentation and discussion of progress reports on research, special problems and outstanding publications in forestry and related fields.

Cooper

FOR 692 Advanced Forest Management Problems. *Preq.: Grad. standing. Credits Arranged. F,S,Sum.* Directed studies in forest management.

Graduate Staff

FOR 699 Problems and Research. *Preq.: Grad. standing. Credits Arranged. F,S,Sum.* Specific forestry problems that will furnish material for a thesis.

Graduate Staff

Genetics

GRADUATE FACULTY

Professor D. F. Matzinger, Acting Head

Professors: G. C. Bewley, D. S. Grosch, W. D. Hanson, W. E. Kloos, C. S. Levings III, R. H. Moll, J. G. Scandalios, H. E. Schaffer, A. C. Triantaphyllou; *Professor (USDA):* C. W. Stuber; *Professor (USFS):* G. Namkoong; *Professors Emeriti:* C. H. Bostian, T. J. Mann, L. E. Mettler, S. G. Stephens; *Associate Professors:* C. C. Laurie-Ahlberg, W. H. McKenzie, S. L. Spiker; *Assistant Professors:* M. A. Conkling, S. E. Curtis, T. H. Emigh

ASSOCIATE MEMBERS OF THE DEPARTMENT

Professors: J. L. Apple, F. B. Armstrong, C. C. Cockerham, E. J. Eisen, D. A. Emery, E. W. Glazener, M. M. Goodman, F. L. Haynes Jr., J. E. Legates, B. T. McDaniel, T. O. Perry, L. L. Phillips, J. O. Rawlings, O. W. Robison, L. C. Saylor, D. H. Timothy, B. S. Weir, E. A. Wernsman; *Professor (USDA):* J. F. Chaplin

Graduate study under the direction of the genetics faculty may enable the student to qualify for the Master of Science or the Doctor of Philosophy degrees. A candidate for the master's degree must acquire a thorough understanding of genetics and its relation to other biological disciplines and must present a thesis based upon one's own research. In addition to a comprehensive knowledge of his or her field, a candidate for the doctorate must demonstrate a capacity for independent investigation and scholarship in genetics.

At North Carolina State University there are no sharp divisions along departmental lines or between theoretical and applied aspects of genetics research. The members and associate members of the genetics faculty are located in six different departments of the Schools of Agriculture and Life Sciences, Forest Resources and Physical and Mathematical Sciences. They are studying a wide range of genetic problems and are utilizing not only the "classic" laboratory materials (maize, bacteria, *Drosophila*, tobacco, mice), but also farm animals and agricultural and forest plants of the region. A student has, therefore, a wide choice of research problems in any of the following fields: cytology and cytogenetics, microbial and biochemical genetics, molecular and developmental genetics, evolution and speciation, quantitative and population genetics and the application of genetics to breeding methodology.

Departmental offices and laboratories are located in Gardner Hall with greenhouse facilities adjacent to the building. A genetics garden for use in intensive research with plants and teaching functions is located three miles from the offices. The departmental staff and the associate faculty members in animal science, biochemistry, crop science, horticultural science, plant pathology, statistics and the School of Forest Resources are fortunate in being able to draw upon the extensive facilities of the North Carolina Agricultural Research Service.

SELECTED ADVANCED UNDERGRADUATE COURSES

GN 411 The Principles of Genetics. *Preqs.: BS 100, jr. standing. 3(3-0) F,S.*

GN 412 Elementary Genetics Laboratory. *Preq. or coreq.: GN 411. 1(0-2) F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

GN 504 Human Genetics. *Preq.: GN 301 or 411 or equivalent. 3(3-0) F.* The basic principles needed for an understanding of the genetics of man. Current knowledge and important areas of research in human genetics. McKenzie

GN 505A,B,C,D Genetics I. *Preq.: GN 411. 1-4 F.* Principles presented as a series of five-week minicourses: GN 505A, molecular genetics; GN 505B, biochemical genetics; GN 505C, developmental genetics. The laboratory, GN 505D, involves experimental techniques in genetics and extends throughout the semester. Majors and minors must enroll for the entire course. Others may enroll for specific minicourses and attend the first lecture of semester for schedule. Graduate Staff

GN 506A,B,C Genetics II. *Preq.: GN 411; Coreq.: ST 511. 1-3 S.* Principles presented as a series of five-week minicourses: GN 506A, population genetics; GN 506B, quantitative genetics; GN 506C, cytogenetics. Majors and minors must enroll for the entire series. Others may enroll for specific minicourses and attend the first lecture of the semester for schedule. Graduate Staff

GN (ANS) 508 Genetics of Animal Improvement. *3(3-0) S.* (See animal science.)

GN (PO) 520 Poultry Breeding. *3(2-2) S.* (See poultry science.)

GN (ZO) 532 Biological Effects of Radiations. *Preq.: BS 100, or GN 301 or CI. 3(3-0) S.* Qualitative and quantitative effects of radiations (other than the visible spectrum) on biological systems, to include both morphological and physiological aspects in a consideration of genetics, cytology, histology, morphogenesis and ecology. Graduate Staff

GN (ZO) 540 Evolution. *Preq.: Nine credits in biological sciences. 3(3-0) S.* The nature of organic evolution is explored by examining the types of evidence that allow reconstruction of the history of life on earth as well as experimental and descriptive evidence regarding the mechanisms of genetic change in populations.
Laurie-Ahlberg

GN (CS, HS) 541 Plant Breeding Methods. *3(3-0) F.* (See crop science.)

GN (CS, HS) 542 Plant Breeding Field Procedures. *2(0-4) Sum.* (See crop science.)

GN (CS) 545 Origin and Evolution of Cultivated Plants. *2(2-0) S.* (See crop science.)

GN (BO, CS, HS) 547 Cell and Tissue Techniques in Plant Breeding. *3(1-4) F. Alt. yrs.* (See crop science.)

GN 555 Population Genetics. *Preqs.: GN 506A, MA 102. 3(3-0) S. Alt. yrs.* Theoretical population genetics and its relationship to natural and experimental populations. Topics include: single locus and multilocus systems, history of a gene in a population, diffusion approximations, suitability of models to natural and experimental populations.
Emigh

GN 560 Molecular Genetics. *Preqs.: GN 411; BCH 451. 3(3-0) F.* A discussion of the structure and function of the genetic material at a molecular level. Both prokaryotic and eukaryotic systems will be considered. The aim will be to describe genetics in terms of chemical principles.
Spiker

GN (BCH) 561 Biochemical and Microbial Genetics. *Preqs.: BCH 451 or 551, GN 411 or 505, MB 401 or equivalent. 3(3-0) S.* A study of the development of the fields of biochemical and microbial genetics, emphasizing both techniques and concepts currently used in molecular research. Includes lectures and discussions of current research publications.
Armstrong

GN 567 Molecular Cytogenetics. *Preq.: GN 505 or equivalent. 3(3-0) F. Alt. yrs.* A molecular-genetic analysis of the structure function and evolution of eukaryotic genomes. Current methodology and approaches will be discussed, including DNA sequence analysis, chromosomal proteins, specific repeated genes, transposable elements in eukaryotic systems, structure and evolution of organelle genomes and use of recombinant DNA techniques in studies of chromosome structure.
Graduate Staff

FOR GRADUATES ONLY

GN (ANS) 603 Population Genetics in Animal Improvement. *3(3-0) F.* (See animal science.)

GN (FOR) 611 Forest Genetics. *3(3-0) S.* (See forestry.)

GN (FOR) 612 Advanced Topics in Quantitative Genetics. *3(3-0) F.* (See forestry.)

GN (CS, HS) 613 Plant Breeding Theory. *3(3-0) S.* (See crop science.)

GN (ST) 626 Statistical Concepts in Genetics. *3(3-0) S.* (See statistics.)

GN 633 Physiological Genetics. *Preq.: GN 505 or equivalent. 3(3-0) S.* Recent advances in physiological genetics. Attention will be directed to literature on the nature and action of genes, and to the interaction of heredity and environment in the expression of characteristics of higher organisms.
Graduate Staff

GN 641 Colloquium in Genetics. *Preqs.: Grad. standing; CI. 2(2-0) F,S.* Informal group discussion of prepared topics assigned by the instructor.
Graduate Staff

GN 650 Developmental Genetics. *Preq.: GN 505. 3(3-0) S. Alt. yrs.* The action and regulation of genes and gene-products in development and differentiation. Examples will be taken from microorganisms, plants and animals. Emphasis will be placed on molecular and biochemical aspects of mechanisms controlling gene expression in eukaryotic cell differentiation. Curtis

GN 651 Somatic Cell Genetics. *Preqs.: GN 505; BCH 451. 3(3-0) S. Alt. yrs.* Discussion of the use of non-germ line cells for the genetic analysis of eukaryotic organisms. Plant, animal and fungal systems will be considered. Topics include: mutagenesis, selection, cell fusion, parasexual cycles, cloning, genetic engineering and regeneration of whole organisms. Spiker

GN 666 Laboratory in Molecular Genetics. *Preqs.: GN 505 or equivalent and CI. 4(2-6) S. Alt. yrs.* A laboratory course in modern techniques of molecular genetics for advanced students. Techniques will include *in situ* hybridization, recombinant DNA methodology, and DNA sequencing. Enrollment is limited to 12 students. Applications for a place in the course may be obtained from the department. Conkling

GN 691 Seminar. *Preq.: Grad. standing. 1(1-0) F,S.* Graduate Staff

GN 694 Selected Topics in Cytogenetics. *Preqs.: GN 506 or CI. 2(2-0) F,S.* Readings and discussions of original cytogenetic literature. Chromosome replication, DNA redundancy, heterochromatin, models of crossing over and somatic cell genetics are some of the areas included. Topics of special interest to class members will also be covered. Graduate Staff

GN 695 Special Problems in Genetics. *Preqs.: Advanced grad. standing, CI. 1-3 F,S.* Special topics designed for additional experience and research training. Graduate Staff

GN 699 Research. *Preqs.: Grad. standing, permission of adviser. Credits Arranged.* Original research related to the student's thesis problem. A maximum of six credits for the master's degree; by arrangement for the doctorate. Graduate Staff

Graduate School Registrations (GR)

For information regarding these registrations, see Special Registration and Fees.

History

GRADUATE FACULTY

Professor B. F. Beers, Head

Professor W. C. Harris, Assistant Head

Associate Professor J. R. Banker, Graduate Administrator

Professors: W. H. Beezley, C. H. Carlton, M. S. Downs, J. P. Hobbs, D. E. King, J. M. Riddle, R. H. Sack, S. Suval, E. D. Sylla, B. W. Wishy; Adjunct Professor: R. L. Greaves; Professors Emeriti: M. L. Brown Jr., R. W. Greenlaw, M. E. Wheeler; Associate Professors: A. J. LaVopa, L. O. McMurry, J. A. Mulholland, G. D. Newby, G. W. O'Brien, J. K. Ocko, R. W. Slatta; Associate Professor Emeritus: R. N. Elliott; Assistant Professors: J. E. Crisp, D. P. Gilmartin, S. A. Glenn, W.

A. Jackson III, S. T. Parker, J. D. Smith, S. L. Spencer, G. D. Surh, K. P. Vickery, K. S. Vincent; *Adjunct Assistant Professors*: N. B. Ketchiff, D. J. Olson, W. S. Price Jr., H. K. Steen

ASSOCIATE MEMBER OF THE DEPARTMENT

Assistant Professor: J. C. Bonham

The history department offers programs leading to the Master of Arts degree in history and Master of Arts degree in archival management. Although no specific courses are stipulated for admission to the programs, preference will be given to those students with at least 18 hours in history and a total of 30 hours in the social sciences. Candidates are expected to have taken the aptitude portion of the Graduate Record Examination, or if admitted provisionally, must do so before the end of their first semester. Candidates are requested to include brief statements of their objectives in entering the programs along with their applications.

Normally a degree candidate for a Master of Arts in history will concentrate work in either European or American history with the required total of 30 hours being made up of nine to twelve hours of course work at the 500 level or above; six hours of research seminar (600 level); up to six hours of research and preparation of thesis (600 level); and six to nine hours of course work in a field related to the candidate's area of concentration (500 or 600 level). Under special circumstances a candidate may be permitted to include a 400-level course (see undergraduate catalog for descriptions) in his or her program if it has particular relevance to one's program objectives. Social studies teachers may be awarded G certification through completion of a degree with a major in history and a minor in education.

The Master of Arts in archival management requires thirty-six hours of courses, including two three-hour practicums in lieu of the thesis. Half of the course hours fall in historical studies, the rest in archival management. One practicum places the student under the direct supervision of the State Archivist of North Carolina. Students may select the other areas of interest—college archives, history sites administration, museology, historical preservation or others.

One fellowship, one graduate scholarship and three teaching assistantships are now offered. Inquiry should be addressed to the graduate administrator.

North Carolina State University is a member of the Folger Institute of Renaissance and Eighteenth-Century Studies, a unique collaborative enterprise sponsored by the Folger Shakespeare Library in Washington, D.C., and twenty universities in the Middle Atlantic region. Each year the Institute offers an interdisciplinary program in the humanities—seminars, workshops, symposia, colloquia and lectures. Admission is open to faculty and students of North Carolina State University, and a limited number of fellowships are available through the Campus Folger Institute Committee.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

NOTE: Prerequisite: (500 level) Six hours of advanced history or equivalent.

HI 509 The High Middle Ages. *Credit in both HI 409 and HI 509 is not allowed. 3(3-0).* An analysis of various aspects of medieval culture for the period 936-1250. Selected topics will be examined using source readings in such subjects as the revival of the Roman Empire, monastic and papal reform, the rise of universities, the evolution of representative bodies, the Gothic style, troubadour and goliardic poetry, scholasticism and the revival of Roman law. Riddle

HI 515 Revolutionary Europe. *Credit in both HI 415 and HI 515 is not allowed. 3(3-0).* A broadly based analysis of Europe's first revolutionary era. Topics covered are the Enlightenment and its impact, the causes and character of the Revolution in France and the impact of these events in France and Europe. Graduate Staff

HI 516 Europe in Life and Work, 1750-1850. *Credit in both HI 419 and HI 519 is not allowed. 3(3-0).* An historical examination of social traditions and change in Europe (especially England, France and Germany) from the mid-18th to the mid-19th century, including both rural and urban life. Population growth and its effects, changes in lower and middle class family life, the evolution of labor, the experience and perception of poverty and types of popular protest. Graduate Staff

HI 518 Fascism in Germany and Italy, 1919-45. *Credit in both HI 418 and HI 518 is not allowed. 3(3-0).* Hitler and Mussolini: two aspects of European fascism. Suval

HI 519 Modern European Imperialism. *Credit in both HI 419 and HI 519 is not allowed. 3(3-0).* Historical background of European Colonialism. Its influence on modern independence movements and major power foreign policy. Third World concept in international relations. Graduate Staff

HI 528 England in the Age of the American Revolution. *3(3-0).* An intensive study of English political, religious, economic, social and imperial ideas and institutions between 1763 and 1783 with special emphasis on how these affected and were affected by the War of the American Revolution. Downs

HI 539 History of the Soviet Union. *Credit in both HI 439 and HI 539 is not allowed. 3(3-0).* History of the Soviet Union from the revolutions of 1917 to the present, emphasizing political, economic and cultural developments that have molded the Soviet state and society. Attention is also given to foreign policy with emphasis on the position of the Soviet Union in the world since 1945. Surh

HI 542 The United States: Revolution to Constitution. *Credit in both HI 442 and HI 542 is not allowed. 3(3-0).* The conflict with Great Britain after 1763 leading to the declaring of independence; the war for American independence; the political, social and ideological problems in establishing the government of the new nation. Graduate Staff

HI 546 Reconstruction of the American Union. *Credit in both HI 446 and HI 546 is not allowed. 3(3-0).* A study of the period of sectional strife, war and reconstruction, including a close examination of the sectional polarization of the 1850s, the impact of the war on both northern and southern societies and the trauma of reconstructing the Union. Harris

HI 554 History of U. S. Foreign Relations, 1900-Present. *Credit in both HI 454 and HI 554 is not allowed. 3(3-0).* American diplomatic history since 1900; the expansion of American economic and cultural relations; the evolution of the American foreign policy bureaucracy; and the historical forces and personalities that shaped American relations with other nations. Beers

HI 557 U. S. Social History Methods. *Credit in both HI 457 and HI 557 is not allowed. 3(3-0).* Introduction to U. S. social history. Survey of methodologies, quantification, social

science theory, comparative analysis, with application to in-depth investigation of selected themes, including demography, class, ethnicity, labor, race and sex. O'Brien

HI 561 Civilization of the Old South. *Credit in both HI 461 and HI 561 is not allowed. 3(3-0).* The distinctive features of the Old South as part of the regional development of the United States. Colonial factors in the making of the South, development of the plantation system and slavery, Southern social order, intellectual and cultural life, economic development and rise of Southern nationalism. Graduate Staff

HI 565 The History of Urban Life in the U.S., 1607-1865. *Credit in both HI 465 and HI 565 is not allowed. 3(3-0).* The historical background of today's urban problems. King

HI 566 The History of Urban Life in the U.S., 1865-Present. *Credit in both HI 466 and HI 566 is not allowed. 3(3-0).* The historical background of today's urban problems. King

HI 569 Latin American Revolutions in the Twentieth Century. *Credit in both HI 469 and HI 569 is not allowed. 3(3-0).* The varieties of revolutionary changes in twentieth-century Latin American revolutions: Argentina, Bolivia, Peru, Cuba and Chile. Beezley, Slatta

HI 576 Leadership in Modern Africa. *Credit in both HI 476 and HI 576 is not allowed. 3(3-0).* The conditions under which 20th century African leaders have obtained and exercised power. Case studies of prominent leaders, both radicals, reactionaries, democrats and tyrants, such as Nkrumah, Kenyatta, Nyerere, Amin, Cabral, Vorster and Senghor. Graduate Staff

HI 581 History of Life Sciences. *Credit in both HI 481 and HI 581 is not allowed. 3(3-0).* Surveys the major ideas, methods, institutions and individuals that have contributed to the biological sciences from antiquity to modern times and examines the connections between the life sciences and other aspects of culture, including the physical sciences, religious belief, medical practice and agriculture. Students in the History of Life Sciences will read original sources and historical monographs concerning those topics. Sylla

HI 585 Principles and Practice of Applied History. *Preqs.: Grad. standing; 6 hours of history or equivalent. Credit in both HI 485 and HI 585 is not allowed. 3(3-0).* An introduction to applications of history to public life and to the conservation and presentation of historical materials, with particular attention to conservation problems generated by modern technology. Topics include archives, records management, historical editing, museology, historical preservation, special forms of presentation like historic sites and audiovisual techniques and computer applications. Smith

HI 586 History and Principles of the Administration of Archives and Manuscripts. *Credit in both HI 486 and HI 586 is not allowed. 3(3-0).* Nature, importance and use of original manuscript resources; the history and evolution of written records and the institutions administering them; the principles and practices of archives administration. Olson

HI 587 Application of Principles of Administration of Archives and Manuscripts. *Preqs.: Six hours of advanced history and HI 586. Credit in both HI 487 and HI 587 is not allowed. 3(3-0).* Internship training in the application of the principles and practices of archival management as developed in HI 586. Olson

HI 598 Special Topics in History. 1-6. An investigation of topics of particular interest to advanced students under the direction of faculty members on a tutorial basis. Graduate Staff

FOR GRADUATES ONLY

NOTE: Prerequisite: (600 level) Six hours of advanced history or equivalent.

HI 601 Historiography and Historical Method. 3(3-0). A study of the major steps in the development of historical investigation; analysis of elements of historical research; discussion of methodology and archival materials used by the contemporary scholarly historian.
Graduate Staff

HI 602 Seminar in American History. 3(3-0). A small research seminar on special topics in American history.
Graduate Staff

HI 688 Iconographic and Other Archival Materials. *Preq.: HI 485/585.* 3(2-2). Introduction to archival materials. Examination of and practice in the storage and care of paper and books, prints, engravings and maps. Films, transparencies, negatives, magnetic tapes and phonorecords. Emphasis on preventive conservation.
Smith

HI 689 Documentary Editing. *Preq.: HI 485/585.* 3(3-0). An introduction to the field of documentary editing. Development of historical editing and the rules of literal, expanded and modern editorial method. Special documentary/papers projects.
Smith

HI 691 Practicum in Applied History. *Preq.: HI 601, 602, 685.* 1-6. Supervised internship experience in an archival management and/or applied history.

HI 699 Research in History. *Credits Arranged.* 1-6. Individual research under graduate thesis supervisor.
Graduate Staff

Horticultural Science

GRADUATE FACULTY

Professor A. A. De Hertogh, Head

Professor F. L. Haynes, Graduate Coordinator

Professors: W. E. Ballinger, R. T. Konsler, R. A. Larson, J. W. Love, C. M. Mainland, C. H. Miller, T. J. Monaco, P. V. Nelson, D. M. Pharr, J. C. Raulston Jr., D. C. Sanders, W. A. Skroch, C. R. Unrath, L. G. Wilson; *Adjunct Professor:* R. L. Sawyer; *Professors Emeriti:* F. D. Cochran, J. M. Jenkins, D. T. Pope; *Associate Professors:* J. R. Ballington, T. E. Bilderback, F. A. Blazich, V. P. Bonaminio, W. W. Collins, P. R. Fantz, W. C. Fonteno III, R. G. Gardner, W. R. Henderson, L. E. Hinesley, E. B. Poling, T. C. Wehner, D. J. Werner, E. Young; *Associate Professor (USDA):* L. K. Hammett; *Associate Professors Emeriti:* T. F. Cannon, D. C. Zeiger; *Assistant Professors:* S. M. Blankenship, A. R. Bonanno, R. G. Goldy, W. E. Hooker, W. J. Lamont Jr., M. M. Peet, K. B. Perry, K. M. Williams; *Lecturer:* M. E. E. Traer

ASSOCIATE MEMBERS OF THE DEPARTMENT

Professors: D. E. Carroll Jr., R. J. Downs, R. H. Moll, R. L. Mott; *Professor Emeritus:* R. Aycock

Graduate study under the direction of the horticultural science faculty may lead to the Master of Science and the Doctor of Philosophy degrees. Areas of study include plant physiology, plant breeding and genetics, post-harvest physiology, plant nutrition, tissue culture, growth regulators and weed science. The Master of Agriculture, a professional degree, can be earned by substituting additional course work for research requirements of graduate study.

Facilities for graduate studies on the Raleigh campus include a 30,000 square-foot greenhouse (21 sections, each with separately controlled light and temperature); the University Phytotron (available for controlled environmental studies on horticultural crops); 19 well-equipped laboratories (chromatography, seed handling and storage, cytological/anatomical, radioisotope, tissue culture, post-harvest and nutritional studies). There are 14 controlled temperature storage rooms; an extensive collection of plant materials, both living (NCSU Arboretum) and preserved; and a variety of climates and soils from coast to mountains in North Carolina on 15 outlying research stations.

Opportunities for employment after graduate study include: teaching and research faculty positions in state and private universities; research and regulatory positions with the Departments of Agriculture, both foreign and domestic; extension specialists and county agents; research, production and promotional work with agri-business concerned with production of horticultural crops or services to horticultural industries.

Graduate teaching and research assistantships (commercial, Agricultural Foundation or N.C. Agricultural Research Service) for promising students are available. Students are encouraged to apply for assistantships at least six months prior to the anticipated enrollment date.

SELECTED ADVANCED UNDERGRADUATE COURSES

HS 400 Residential Landscaping. *Preqs.: DF 234; HS 211, 212, 342; HS 416 or DN 433; SSC 200, DN 257, 430. Seniors in the landscape area of concentration given priority. 6(0-9) F, S.*

HS 411 Nursery Management. *Preqs.: BS 100, SSC 200, jr. standing. 3(2-3) F.*

HS 416 Principles of Ornamental Planting Design. *Preqs.: HS 211, HS 212, HS 342, SSC 200, DN 234. 3(2-4) F.*

HS 421 Tree Fruit Production. *Preqs.: BS 100 or BO 200, SSC 200, HS 201. 3(2-3) F.*

HS 422 Small Fruit Production. *Preqs.: BS 100 or BO 200, SSC 200, HS 201. 3(2-3) S. Alt. yrs.*

HS 431 Vegetable Production I. *Preqs.: BS 100, SSC 200. 4(3-3) F.*

HS 440 Greenhouse Management. *Preqs.: BS 100, SSC 200. 3(2-3) F.*

HS 441 Floriculture I. *Preqs.: BS 100, SSC 200. 3(2-3) F.*

HS 442 Floriculture II. *Preqs.: BS 100, SSC 200. 3(2-3) S.*

HS 471 Tree and Grounds Maintenance. *Preqs.: BS 100 or BO 200; PP 315; SSC 200. 4(3-3) S.*

HS 491 Horticultural Science Seminar. *Preq.: Jr. standing in horticultural science. 1(1-0) F.*

HS 495 Special Topics in Horticultural Science. 1-6 F,S.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

HS (CS) 514 Principles and Methods in Weed Science. *Preq.: CS 414 or equivalent. 3(2-2) S.* Studies on the losses caused by weeds, the ecology of weeds, biological control, basic concepts of weed management, herbicide-crop relationships and herbicide development. Introduction to greenhouse and bioassay techniques used in herbicide work and to field research techniques supplemented by laboratory and field exercises. Monaco

HS 531 Physiology of Landscape Plants. *Preq.: BO 421 or CI. 3(2-3) S.* A course designed to cover relationships of plants to landscape environments. Study of plant function, basic climatology and plant physiological principles involved in the selection, utilization and maintenance of physical landscape environments in exterior and interior ornamental landscape plantings. Raulston

HS 532 Vegetable Crop Physiology. *Preqs.: BO 421, HS 431, SSC 341. 2(2-0) F. Alt. yrs.* Physiological aspects of field and greenhouse vegetable production: germination, photoperiod, nutrition, growth regulations, fruit quality, physiological disorders, source-sink interactions, environmental physiology and physiological aspects of plant protection. Emphasis on current areas of research and the physiological implications of new production techniques. Graduate Staff

HS 534 Vegetable Crops Practicum. *Preq.: HS 431. 3(1-6) S. Alt. yrs.* Field techniques for research on vegetable production problems. Eleven all-day field trips (two overnight) are required during the period May-August. Graduate Staff

HS (CS, GN) 541 Plant Breeding Methods. 3(3-0) F. (See crop science.)

HS (CS, GN) 542 Plant Breeding Field Procedures. 2(0-4) Sum. (See crop science.)

HS (BO, CS, GN) 547 Cell and Tissue Techniques in Plant Breeding. 3(1-4) F. Alt. yrs. (See crop science.)

HS (FS) 562 Postharvest Physiology. *Preq.: BO 421. 3(3-0) S.* A study of chemical and physiological changes that occur during handling, transportation and storage which affect the quality of horticultural crops. Consideration will be given to preharvest and postharvest conditions which influence these changes. Graduate Staff

HS 595 Special Topics in Horticultural Science. *Preq.: CI. 1-6 F,S,Sum.* Investigation of special theoretical problems at the 500 level in horticultural science not related to a thesis problem; new 500-level courses during the developmental phase. Graduate Staff

HS 599 Research Principles. *Preq.: CI. Credits Arranged, Maximum 6.* Investigation of a problem in horticulture under the direction of the instructor. The students obtain practice in experimental techniques and procedures, critical review of literature and scientific writing. The problem may last one or two semesters. Credits will be determined by the nature of the problem, not to exceed a total of three hours for any one problem. A written report and final oral exam required for completion of course. Graduate Staff

FOR GRADUATES ONLY

HS (CS, GN) 613 Plant Breeding Theory. 3(3-0) S. (See crop science.)

HS (CS, SSC) 614 Herbicide Behavior in Plants and Soils. *3(3-0) F.* (See crop science.)

HS 621 Methods and Evaluation of Horticultural Research. *Preq.: Grad. standing. 3(3-0) F.* Study of necessary elements for a career in horticultural research including: background and philosophy of scientific research; survey of horticultural research history and current status; research design and evaluation; photographic techniques; technical writing including project proposals, administrative reports and publications; office and personnel management. Raulston

HS 622 Mineral Nutrition in Plants. *Preqs.: BO 551, 552. 3(2-3) S. Alt. yrs.* A comprehensive study of the functional roles of nutrients essential to plant growth, their interrelationships and their mode of influence on quality indices of crops. Consideration of the complexity of mineral nutrition experimentation and evaluation of results. A detailed look at the establishment and application of foliar analysis, foliar fertilization and slow-release fertilizers. A general view of the nutrient uptake process in plants. (Offered 1986-87 and alt. years.) Nelson

HS 691 Seminar. *Preq.: Grad. standing. 1(1-0) F,S.* Required of all horticultural science graduate students. Presentation of scientific articles and special lectures. Students will be required to present one or more papers. Graduate Staff

HS 695 Graduate Topics in Horticultural Science. *Preq.: CI. 1-6 F,S,Sum.* Investigation of theoretical problems at the 600 level in horticultural science not related to a thesis problem; new 600-level courses during the development phase. Graduate Staff

HS 699 Research. *Preqs.: Grad. standing in HS, consent of advisory committee chairman. Credits Arranged.* A maximum of six credits is allowed toward the Master of Science degree; no limitation on credits in doctoral program. Original research on specific problems in fruit, vegetable and ornamental crops. Graduate Staff

Industrial and Technical Education

For a listing of graduate faculty and program information, see industrial and technical education in the education section.

Industrial Arts Education

For a listing of graduate faculty and program information, see industrial arts education in the education section.

Industrial Engineering

GRADUATE FACULTY

Professor T. J. Hodgson, Head

Professor R. G. Pearson, Graduate Administrator

Professors: R. E. Alvarez, M. A. Ayoub, R. H. Bernhard, J. R. Canada, S. E. Elmaghaby, A. L. Prak, W. A. Smith Jr., S. Stidham Jr.; Adjunct Professor: E. R. MacCormac; Professors Emeriti: C. A. Anderson, R. G. Carson Jr., R. W.

Llewellyn; *Associate Professors*: M. K. Joost, H. L. W. Nuttle; *Visiting Associate Professor*: H. Paul; *Adjunct Associate Professor*: D. C. Antonelli; *Associate Professor Emeritus*: J. J. Harder; *Assistant Professors*: H. Bao, C. T. Culbreth Jr., Y. Fathi, E. L. Fisher, R. E. King, C. B. Oldham, E. T. Sani; *Visiting Assistant Professor*: J. E. Richards; *Adjunct Assistant Professors*: A. J. Barwick, J. Taheri

Industrial engineering is concerned with solutions to problems relating to design and control of organizational systems, such as industrial and commercial corporations, government agencies and other institutions which provide goods or services for public consumption. Interests include the management of operations, planning and scheduling, manufacturing engineering, allocation of resources, dynamic system design, man-machine relationships and occupational safety and health.

The department offers the degrees of Master of Science in both industrial engineering and management and Doctor of Philosophy. The focal points of study are manufacturing systems, ergonomics and production systems. Typical minors are taken in statistics, economics and business, mathematics, psychology and other engineering disciplines.

The M.S. degree may be taken either with or without a thesis. The thesis work for the M.S. degree may account for as many as six semester hours. For the non-thesis option a formal written report, based upon scholarly project work, is required. No thesis is required for the M.I.E. degree. A departmental brochure which details the orientation and requirements for all degrees is available. No foreign language is required at the master's level and a foreign language is optional with the student's advisory committee at the doctoral level.

The University provides access to an outstanding mainframe computer facility at the Triangle Universities Computing Center (TUCC) through conveniently located computer terminals. In addition, the department supports a VAX 11/750 and a MICROVAX II, both of which are networked campus- and nationwide. Other resources include a wide range of microcomputer systems, among which are several INTEL 310 supermicrocomputers and Tektronics graphic terminals. The manufacturing laboratory has a representative sample of basic machine tools and numerical control equipment. A number of robots for part handling and assembly work research exist. Modern material handling equipment, such as computer-controlled carousels and conveyors, and a broad range of programmable controllers are part of the manufacturing cells for research in decision support systems for flexible assembly operations and robotics issues. Facilities for ergonomics research are also excellent for the study of environmental factors, biomechanics, work physiology and human performance assessment. Finally, a laboratory for voice input-output research contains state-of-the-art equipment for research in this contemporary area of interest.

SELECTED ADVANCED UNDERGRADUATE COURSES

IE 401 Stochastic Models in Industrial Engineering. *Freq.: An introductory course in probability and/or math statistics. 3(3-0) F,S.*

IE (CSC) 441 Introduction to Simulation. *Preqs.: MA 202, ST 372, proficiency in a programming language 3(3-0) F,S.*

IE 443 Quality Control. *Preq.: ST 361. 3(2-2) F,S,Sum.*

IE 452 Ergonomics. *Coreq.: IE 352. 3(2-2) F.*

IE 453 Facilities Design. *Preqs.: IE 351, 352. 3(2-2) F.*

IE 481 Engineering Economics (Mini). *Preqs.: Sr. standing and MA 201. Not for IE, CE, EO, and FMM undergraduates or anyone having received credit for IE 301, IE 311, or equivalent. 1(3-0) S.*

IE 482 Work Methods and Measurement (Mini). *Preqs.: Sr. standing and CI. Not for EO, IE and FMM undergraduates or anyone having received credit for IE 332 or equivalent. 1(3-0) F.*

IE 485 Manufacturing Engineering (Mini). *Preqs.: Sr. standing and CI. Not for IE and EO undergraduates or students who have taken MAT 400 or MAT 423. 1(3-0) F,S.*

IE 487 Information Systems (Mini). *Preqs.: Sr. standing and computer programming course. Not for IE or FMM undergraduates or other students having received credit for IE 307 or equivalent. 1(3-0) F.*

IE 488 Production and Inventory Control (Mini). *Preqs.: Sr. standing and CI. Not for IE and FMM undergraduates. 1(3-0) F.*

IE 498 Senior Design Project. *Preqs.: IE 308, IE 352, IE 351, IE 361, IE 311. For industrial engineering majors only. 3(3-0) F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

IE (MA, OR) 505 Linear Programming. *Preq.: MA 405. 3(3-0) F,S.* A study of mathematical methods applied to problems of planning. Linear programming will be covered in detail. This course is intended for those who desire to study this subject in depth and detail. It provides a rigorous and complete development of the theoretical and computational aspects of this technique as well as a discussion of a number of applications.

Fathi, Peterson

IE (OR) 509 Dynamic Programming. *Preqs.: MA 405, ST 421. 3(3-0) S.* An introduction to the theory and computational aspects of dynamic programming and its application to sequential decision problems.

Elmaghraby, Stidham

IE 511 Capital Investment Economic Analysis. *Preqs.: IE 311, ST 371. 3(3-0) F.* Analysis of economic merits of alternatives including interest and income tax considerations. Risk and sensitivity exploration techniques. Introduction to analytical techniques for multiple objectives or criteria. Use of mathematical programming and computers for capital budgeting.

Bernhard, Canada

IE 512 Bayesian Decision Analysis for Engineers and Managers. *Preq.: ST 371 or ST 421. 3(3-0) F.* The Bayesian approach to decision making, with numerous applications in engineering and business. Expected value maximization, decision trees, Bayes' theorem, value of information, sequential procedures and optimal strategies. Axiomatic utility theory and controversies, utility of money, theoretical and empirical determination of utility functions and relationship to mean-variance analysis. Brief introduction to multi-attribute problems, time streams and group decisions.

Bernhard, Canada

IE 515 Advanced Manufacturing Processes. *Preqs.: IE 351 and ECE 331 or equivalent. 3(3-0) F.* The course examines manufacturing processes which involve chemical, electrochemical, electrical, thermo-electric and non-conventional mechanical energy modes. Each process is investigated as to its underlying theory, state-of-the-art technology, interaction with the workpiece material, geometric capability and economics. Bao

IE 516 CAM I: A Systemic Approach to Computer Aided Manufacturing. *Preq.: IE 351 or IE 485. F.* General principles of CAD/CAM integration. Elements of computer graphics. Engineering data base. Computer Process Control. Group Technology concepts and applications. Flexible manufacturing systems. Bao, Sanii

IE 517 CAM II: Software Applications in Computer-Aided Manufacturing. *Preqs.: IE 516. 3(3-0) S.* Computer techniques for controlling machine tool motions. Extensive application of Numerical Control Programming using the APT language. Computer Aided Process Planning through the CAPP system. Theory and applications of Programmable Controllers for Process Control. Various application software for manufacturing use. Bao, Sanii

IE 518 Manufacturing Operations Management. *Preqs.: MA 202 or MA 212; ST (EB) 350 or ST 372. 3(3-0) F.* Concepts, problems and procedures for the management of manufacturing operations. Emphasis will be on forecasting, capacity planning, material requirements planning, scheduling, inventory control and related computer-based control systems. Hodgson, King, Nuttle

IE 521 Management Decision and Control Systems. *Preqs.: IE 421, CSC 421 or equivalent. 3(3-0) S.* Planning and development of comprehensive computer-based information systems to support management decisions. Formal systems concepts; management information requirements. Management science and organizational behavior influences. Data bases and advanced system techniques and concepts. System evaluation and cost effectiveness. Smith

IE 523 Production Planning, Scheduling and Inventory Control. *Preqs.: OR 501 and ST 515 or equivalents. 3(3-0) S.* An analysis of Production-Inventory systems. Discussion of commonly used planning and scheduling techniques. Introduction to the use of math modeling for solution of planning and scheduling problems. Interface with quality control and information systems. Hodgson, King, Nuttle

IE 525 Organizational Planning and Control. *Preq.: Three credit hours in operations management (such as EB 325, IE 308). 3(3-0) F.* Organization theory and systems approaches to administrative functions. Human and social influences of management systems for planning and control of activity. Policy, structure and procedure related to industrial engineering activities. Effects of automation. Oldham, Smith

IE (PSY) 540 Human Factors in Systems Design. *Preq.: IE 452; Coreq.: ST 507 or 515. 3(3-0) F.* Introduction to the systems development cycle, Man-machine function allocation, design standards, display and control systems, workspace layout, the personnel sub-system concept, anthropometry and maintainability design. Pearson

IE 541 Systems Safety Engineering. *Preqs.: IE 452, ST 371. 3(3-0) S.* Problems in occupational safety and health; OSHA standards; preventive aspects involving product and work design and personnel selection. Consideration of the methods used in accident-injury study, including field investigation, experimental engineering and biomedical research, and statistical and epidemiological studies. Managerial aspects of safety accountability. Product liability and forensics. Pearson

IE 542 Physiological Criteria in Work Measurement. *Preq.: Grad. status. 3(3-0) F.* Alt. yrs. Emphasis is placed on basic endocrine and autonomic nervous system anatomy and

physiology; measures reflecting sympathetic nervous system activity; concepts applicable to work measurement studies including a discussion of arousal theory and the concept of autonomic balance; and survey of current literature on equipment design and use. Joost

IE 544 Occupational Biomechanics. *Preq.: Grad. standing in engineering. 3(2-2) F. Alt. yrs.* General concepts and techniques of understanding the anatomical and physiological bases of human motion. Characteristics and limitations of human motor capabilities, body mechanics and use of biomedical instrumentation for monitoring and quantifying human performance. Applications of biomechanics in work, industry, rehabilitation, sports, space research and safety are also considered. Ayoub

IE 547 Reliability and Quality Assurance. *Preq.: One of the following: IE 308, IE 371, ST 421 or ST 515. 3(3-0) S.* An introduction to basic concepts of reliability and quality assurance. Application of probability and statistics to estimation and control of quality and reliability of industrial processes. Control charts and acceptance sampling. Reliability estimation, life testing. Failure distributions and rates. Reliability of systems: series, parallel and monotone systems. Maintenance of systems. Redundancy optimization. Quality management in industrial systems. Prak, Richards, Stidham

IE 553 Materials Handling Systems. *Preq.: IE 453. 3(3-0) S.* Analysis, design, evaluation and implementation of materials handling systems. Principles, functions, equipment concepts and traditional approaches of materials handling. Impact of facilities design on materials handling and application of quantitative techniques to materials handling systems design. Description of factors and approaches to materials handling management and the criticality of properly designed and operated material flow systems. Fisher

IE 556 Industrial Logistics. *Preq.: IE 453. 3(3-0) F.* Materials management, materials flow and physical distribution. Management of activities required to move raw materials, parts and finished inventory from vendors, within an enterprise and to customers. This course will cover the design and operation of effective industrial logistics systems. Fisher

IE (OR) 561 Queues and Stochastic Service Systems. *Preq.: MA 421. 3(3-0) F.* General concepts of stochastic processes are introduced. Poisson processes, Markov processes and renewal theory are presented. These are then used in the analysis of queues, starting with a completely memoryless queue to one with general parameters. Applications to many engineering problems will be considered. Perros, Stewart, Stidham

IE (CSC, CSE, ECE, OR) 562 Computer Simulation Techniques. *3(3-0) F.* (See computer studies.)

IE (MA, OR) 586 Network Flows. *Preq.: IE (OR, MA) 505 or equivalent. 3(2-2) S. Alt. yrs.* This course will study problems of flows in networks. These problems will include the determination of the shortest chain, maximal flow and minimal cost flow in networks. The relationship between network flows and linear programming will be developed as well as problems with nonlinear cost functions, multicommodity flows and the problem of network synthesis. Elmaghraby, Fathi

IE 589 Special Topics in Industrial Engineering. *Preqs.: Grad. or sr. standing and CI. 1-4.* Exploration of emerging topics of interest to faculty and students. Generally used for the first offering of a new course, using conventional lecture format. Sometimes used for direct-readings, problem sets and reports as required. Graduate Staff

IE 591 Project Work. *Preq.: Grad. standing. 1-6 F,S,Sum.* Investigation and report on assigned problems requiring application of industrial engineering techniques. Graduate Staff

IE (PSY) 593 Area Seminar in Ergonomics. *1(0-2) F.* (See psychology.)

FOR GRADUATES ONLY

IE 611 The Design of Production Systems. *Preqs.: IE (MA, OR) 505, OR 501. 3(3-0) F. Alt. yrs.* The study of production systems: the model, the criterion, decision making and optimization, levels of decision. The graphic representation of systems: signal flow graphs, activity analysis, networks of flow models. The machine assignment problem, scheduling and sequencing, line balancing location-allocation of new facilities. The use of computers in the design of production systems. Elmaghraby

IE 621 Advanced Problems in Management Systems Engineering. *Preq.: CI. 1-4 S.* Coverage of advanced techniques, current research and contemporary problems in analysis, design and operation of management systems. Varied topics will cover aspects of economic decision analysis, cost effectiveness, information flow, system performance evaluation and modern organization concepts. Bernhard, Canada, Smith

IE 622 Inventory Control Methods II. *Preq.: IE 523. 3(3-0) F.* A continuation of IE 523; stochastic inventory systems of lot sized-reorder type; periodic review and single period models. Application of dynamic programming theory to deterministic and stochastic cases. King, Nuttle

IE (PSY) 640 Skilled Operator Performance. *Preqs.: PSY 545, ST 507, or ST 515. 3(3-0) S. Alt. yrs.* Theories of the human operators are considered with regard to the classical problems of monitoring, vigilance and tracking. Factors such as biological rhythm, sleep loss, sensory restriction, environmental stress and time-sharing are considered as they interact with and determine overall systems efficiency. Pearson

IE 641 Environmental Factors and Human Performance. *Preqs.: IE (PSY) 540 and IE 542 or other equivalent. 3(3-0) S. Alt. yrs.* Study of major problem areas, methodology, theory and experimental work in biotechnology; interaction among engineering, biological and behavioral factors in design for safety and survival; physiology and biomechanics of acceleration, deceleration and pressure altitude; consideration of operator effectiveness in submarine, extra-terrestrial, arctic and desert environments; techniques in evaluation of crash dynamics and pathology; closed-ecological systems. Pearson

IE 651 Special Studies in Industrial Engineering. *Preq.: Grad. standing. Credits Arranged.* The purpose of this course is to allow individual students or small groups of students to undertake studies of special areas in industrial engineering which fit into their particular program and which may not be covered by an existing industrial engineering graduate level course. Problems may require individual research and initiative in the application of industrial engineering training to new areas or fields. Graduate Staff

IE (CSE,OR) 662 Stochastic Simulation Design and Analysis. *Preqs.: CSE (CSC, ECE, IE, OR) 562 and ST 516. 3(3-0) S.* Advanced topics in stochastic system simulation are covered, including random variate generation, output estimation for stationary and non-stationary models, performance optimization techniques, variance reduction approaches. Students apply these techniques to actual simulations. A paper written on a current research topic is required. Bengston, Perros, Richards

IE (OR, MA) 692 Special Topics in Mathematical Programming. *Preq.: IE (MA, OR) 505. 3(3-0) F,S,Sum.* The study of special advanced topics in the area of mathematical programming. New techniques and current research in this area will be discussed. The faculty responsible for this course will select the areas to be covered during the semester according to their preference and interest. This course will not necessarily be taught by an individual faculty member but can, on occasion, be a joint effort of several faculty members from this university as well as visiting faculty from other institutions. To date, a course of Theory of Networks and another on Integer Programming have been offered under the um-

brella of this course. It is anticipated that these two topics will be repeated in the future together with other topics. Graduate Staff

IE 693 Seminar in Applied Ergonomics. *Preqs.: IE (PSY) 540, ST 515. 1(0-2) S.* Discussion of contemporary issues involving the systems approach to accident prevention and injury control. History of safety research; federal health, industrial and military activities in safety, current centers of safety research and their activity. Ayoub, Pearson

IE 694 Advanced Problems in Ergonomics. *Preqs.: IE (PSY) 540, ST 515. 3(3-0) F.* Exploration in depth of a problem area of contemporary interest involving the man-machine-environment interface. Class discussion and analysis of research and theory, with special focus on the human factors aspects of systems design and operation. Ayoub, Joost, Pearson

IE 695 Seminar. *1(1-0) S.* Seminar discussion of industrial engineering problems for graduate students. Case analyses and reports. Graduate Staff

IE 699 Industrial Engineering Research. *Preq.: Grad. standing. Credits Arranged. F,S,Sum.* Graduate research in industrial engineering for thesis credit. Graduate Staff

Integrated Manufacturing Systems Engineering

A list of the graduate faculty participating in the program is available from the IMSE Institute Office.

The Integrated Manufacturing Systems Engineering program was established in 1984 to provide an interdisciplinary course of study in manufacturing systems at the graduate level. The program is administered through the Integrated Manufacturing Systems Engineering Institute, a multifaceted educational, research and technology transfer organization within the School of Engineering. The objective of the academic program is education in the theory and practice of advanced design and manufacturing methods. Central to all aspects of the Institute's operation is the integration of computer-aided techniques in the design of both product and process and in the control of manufacturing facilities. The development and application of this technology requires specially structured academic and research programs to produce graduates capable of bringing about the productivity and quality gains desired by industry.

The academic focus of the Institute is a multidisciplinary master's degree program consisting of courses offered by the Departments of Electrical and Computer Engineering, Industrial Engineering, Mechanical and Aerospace Engineering, Computer Science, and Economics and Business. The degree program provides flexibility to meet the changing needs of industry and students. An interdisciplinary minor is also provided for students who wish to pursue an M.S. or Ph.D. program in a specific department. In either instance, the goal is to provide an academic background essential to the understanding and implementation of computer integrated manufacturing systems.

The IMSE degree program does not include specified major and minor areas of study as normally found in classical master's degree programs. By its very nature, the manufacturing function is multidisciplinary, cutting across traditional engineering disciplines as well as others including economics, business and com-

puter science. The development and use of computer technology in modern manufacturing systems for planning, design, control and information access requires a multidisciplinary approach. Subject matter specialization and concentrations are provided in the student's plan of work through the selection of electives in a specified area of concentration and a research project that complements and reinforces the concentration.

Each student's advisory committee is made up of three or more members of the graduate faculty who associate with and participate in the activities of the Institute. The chairman is normally chosen from the area of concentration the student has selected. Other members of the committee come from the supporting areas of the program.

A typical program of study extends over sixteen months for a student supported on a half-time assistantship. However, it is possible to complete the academic program in as few as twelve months. The curriculum includes a minimum of 27 credit hours of graduate course work in addition to participation in the research activities of the Institute for an additional six hours of credit. Additional course work may be required, dependent upon the background of the student. This may be in the form of intensive immigration modules, or undergraduate courses, for which no graduate credit is received. At least six credit hours must be at the advanced graduate level. The IMSE degree does not require a thesis; however, research papers, formal presentations and reports of thesis quality will be required to be prepared by student teams associated with each research project sponsored by the Institute.

Four areas of course diversity are required of IMSE students: computers and control, design, automation, and business and management. A typical plan of study is structured as follows:

	<i>Credit Hours</i>
Immigration Modules/Courses	0-3
Core Courses	15
Concentration Electives	12
Research Project	6
Total Credit	33-36

<i>Core Courses:</i>	<i>Credit Hours</i>
IE 516 CAM I: A Systemic Approach to Computer-aided Manufacturing	3
IE 518 Manufacturing Operations Management	
or	
IE 523 Production Planning, Scheduling and Inventory Control	3
IE 511 Capital Investment Economic Analysis	3
CSE 501 Design of Systems Programs	
or	
IE 589 Special Topics in Industrial Engineering	3
MAE 589 Special Topics in Mechanical Engineering	3
Total Credit	15

The academic program of each student is tailored to meet specific goals and interests. Suggested plans of study in each of several concentration areas can be obtained by contacting the Program Director in the IMSE Institute Office.

Each student is required to pass a final oral examination as a degree requirement. This examination will consist principally of a formal presentation and defense of the student's participation and accomplishments in the research activity before a jury of review. This jury will consist of the student's advisory committee and industry representatives associated with the project. Only the advisory committee has the authority to pass the student in the examination as currently authorized by the Graduate School. There may be instances in which simultaneous examinations are desirable depending on the nature, breadth and complexity of a specific project. The work of individual students may complement each other's activities such that a total team presentation may be beneficial. In such instances a jury will be present for each student and each advisory committee will exercise its own prerogatives and authority. One committee chairman will be selected out of the entire group by all chairmen to moderate the presentation and defense activity.

International Development

Professor J. L. Apple, Coordinator

The degree of Master of Technology for International Development (MTID) gives an international orientation to the master's degree which is sought in any of the scientific, social and professional fields represented at this university. At a time when the world is moving inexorably toward greater interchange of people and increased commerce among nations, the MTID program provides specialized training for students who are interested in utilizing their skills in international activities, whether technical, consultative or administrative in nature.

The program of work requires the following:

- 1) A total of 36 semester credits, at least half of which must be in the relevant professional area. The remainder of the course work provides special orientation, sensitivity and understanding for work in a foreign culture. Among these "internationalizing" courses, 12 semester credits may be drawn from courses at the 300 or 400 levels with no more than six credits being taken from the 300 level.
- 2) A work experience of a minimum of 12 weeks in a foreign country and a substantial report on that field experience.
- 3) Conversational facility in one foreign language as determined by an oral examination.
- 4) A comprehensive written examination, which may be required at the discretion of the advisory committee.
- 5) Passage of a comprehensive oral examination conducted by the advisory committee.

The program of study is tailored to the student's individual needs rather than following a prescribed course; therefore, the student is expected to be able to demonstrate maturity and assume initiative in planning his/her own course of study. The relevant department assists in choosing a set of courses which provide grounding in the professional area, and the Office of International Programs

assists in identifying appropriate "internationalizing" courses which satisfy the student's particular needs and interests.

The following exemplify MTID plans of study:

Example 1—Core Area: Animal Science

Courses in Animal Science

ANS 502	Reproductive Physiology of Vertebrates	3
ANS 508	Genetics of Animal Improvement	3
ANS 510	Advanced Livestock Management	3
ANS 520	Tropical Livestock Production	3
ANS 540	Ruminant Physiology and Metabolism	3
PO 524	Comparative Endocrinology	4
		19

"Internationalizing" Courses

EB 401	Economics Analysis for Nonmajors	3
HI 476	Leadership in Modern Africa	3
HI 498	Independent Study in History	3
PA 533	Global Problems and Policy	3
PS 431	International Law and Organization	3
SOC 652	Comparative Societies	3
		18
Total semester hours	.....	37

Example 2—Core Area: Public Administration

Courses in Public Administration

PA 511	Public Administration	3
PA 516	Public Policy Analysis	3
PA 612	The Budgetary Process	3
PA 614	Seminar in Management Systems	3
PA 617	Seminar in Organization Theory	3
PA 621	Collective Negotiations in the Public Service	3
		18

"Internationalizing" Courses

EB 448	International Economics	3
HI 415	Revolutionary Europe	3
HI 554	History of U.S. Foreign Relations, 1900-Present	3
PS 641	Seminar in Comparative Politics	3
SOC 503	Contemporary Sociology	3
SOC 514	Developing Societies	3
		18
Total semester hours	.....	36

Recognition that the interdependence of nations and the free exchange of ideas and technology is vital to global survival is now commanding greater attention than at any other time in history. The MTID program is a sophisticated response that equips graduates with the social, philosophical and technical skills necessary

for employment with national and international organizations (profit and non-profit), business firms and government agencies.

General requirements for admission to the MTID program include a Bachelor's degree from an accredited college or university, a grade point average of 3.0 ("B") in one's undergraduate major and satisfactory performance on the Graduate Record Exam.

Landscape Architecture

GRADUATE FACULTY

Professor A. L. Sullivan, Program Director

Professors: C. E. McKinney, T. O. Perry, J. C. Raulston Jr., R. E. Stipe, R. R. Wilkinson; *Professor Emeritus:* E. G. Thurlow; *Associate Professors:* A. R. Abbate, L. L. Jewell, R. C. Moore, D. Wood; *Assistant Professor:* D. W. Dalton; *Lecturers:* R. S. Altman, R. M. Leary

The Master of Landscape Architecture program leads to a professional degree, accredited to qualify students from many different backgrounds for careers in landscape architecture. The program emphasizes design abilities at the community level, based on the premise that community is basic to the design of landscapes. From this perspective, community activities (transportation, recreation, education, etc.) are viewed as making common demands on environmental resources. The goal of the landscape architect is to meet these needs with landscape designs which enhance the human environment while conserving energy and landscape resources.

In the first year, graduate students are introduced to landscape architecture theory and practice in a common program of study which combines coursework with problem-solving studios.

The curriculum offers support courses in public and private design policy, natural and social science methods and communication technologies, and stresses technology appropriate for various uses of the land.

With this background, students choose a concentration in one area of professional practice: site planning, community design or environmental management. The concentration builds on the first-year program with a particular set of theoretical and applied approaches to landscape architecture practice. Each concentration has its own core courses that focus on research methods, professional practice and advanced techniques. A choice of electives allows students to further develop professional skills, based on career interests.

The site planning and design concentration is recommended for students interested in providing design and development services directly to residential, commercial and institutional firms or government agencies. For students seeking a role in the design, development, conservation and preservation of urban environments and neighborhoods, the community design concentration is suggested. The environmental management concentration is advised for students seeking a role in environmental conservation and planning, particularly of rural and forest landscapes.

Beginning in the second year, each student's program is administered by a graduate advisory committee of three faculty nominated by the student and approved by the department head. The committee considers the student's academic background, talents and interests in recommending further courses and studios. Ultimately, the objective is to mesh concepts of a first professional degree with master's level graduate education.

The Master of Landscape Architecture program benefits from its context in the School of Design, gaining the perspectives of related programs in architecture, product design and visual design. In addition, students have access to strong programs in other North Carolina State University departments, such as horticulture, forestry and soil science.

SELECTED ADVANCED UNDERGRADUATE COURSE

LAR 400 Intermediate Landscape Architecture Design (Series). *Preqs.: School of Design majors: DF 102; Horticultural Science-Landscape Technology option majors: DN 234. 6(0-9) F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

LAR 510 Participatory Communication Techniques for Designers. *Preq.: Grad. standing or CI; Coreq.: LAR 600. 3(1-2) F.* A techniques course in which students learn and apply the communication skills necessary in participatory design. An emphasis is placed on communication as a problem-solving process, on visual thinking and on graphic and small group techniques.

LAR 511 Community Design Policy. *Preq.: Grad. standing or CI. 3(3-0) S.* The course explores the theory and practices of the social policy impact on the designed environment and users of that environment. The public community development process is studied as it relates to the built environment.

LAR 512 Landscape Resource Management. *Preq.: DN 431 or CI. 3(1-4) S.* Laboratory techniques course in the methodology of analysis and management of natural resources as it relates to landscape architecture. Case study approach to managed resource systems using spatial mapping and analysis techniques.

LAR 521 Values, Theory and Methods of Landscape Architecture. *Preq.: Grad. standing. 3(3-0) F.* The profession of landscape architecture has undergone radical change in the past decade. Regional analysis, landscape assessment, land development, urban planning, recreation planning, etc., are new and emerging roles for the landscape architect. This course will develop the core values and theories from which each have emerged and survey the techniques and methods of their development.

LAR 530 Advanced Site Planning. *Preqs.: DN 257, DN 430. 3(2-2) S.* An expansion of fundamental site planning techniques applied to development of design proposals including grading, utilities, layout plans, hydrologic calculations, details and specifications.

LAR 531 Project Planning and Design. *Preq.: Grad. standing or CI; Coreq.: LAR 600. 3(3-0) F.* Issues in project planning, activity programming and site development are discussed in conjunction with assigned projects in the local area.

LAR 533 Plants and Design. *3(2-2) Every yr.* The course examines three landscape types: natural landscapes, landscapes altered by man and designed landscapes. Investigation of relevant plant materials and planting design processes is utilized to reveal natural principles

as the basis for a design theory and methodology. Course assignments range from an analysis of actual plant materials and landscapes to the preparation of contract documents.

LAR 551 Ethics of Professional Practice in Landscape Architecture. *Preq.: Grad. standing or CI. 3(3-0) S.* An examination of the place of the professional in society, the contents and philosophies of various professional codes of ethics, the relationship of the practitioner with clients, peers and the public interest. It will include preparation of proposals, conduct as an expert witness, office organization and contracts.

LAR (RRA) 562 Computer Cartography. *3(3-0) S.* (See recreation resources administration.)

LAR 564 Management and Marketing Techniques in Community Design. *3(3-0) S. Alt. yrs.* Methods for effective management of community design processes. Emphasis on personal management skills, group process techniques, publicity materials, public relations and marketing strategies. A technical assistantship with a local agency/organization is required.

LAR 573 Historic Preservation. *Preqs.: Grad. standing and CI. 3(3-0) F.* Seminar covering the legal, administrative, fiscal and political aspects of preserving and conserving buildings, sites, districts, objects and landscapes of architectural, historical and design significance as related to community design and planning considerations. Subjects to be treated include federal, state and local statutes and ordinances; federal and state court decisions and administrative processes.

LAR 574 Landscape and Townscape Conservation. *Preqs.: LAR 511. 3(3-0) S.* Examination of local, state and federal law, affecting the visual quality of large-unit natural and built environments such as landscapes and townscapes, as expressed in local ordinances, state statutes, executive orders, administrative regulations and court decisions. Emphasis is placed on the legal, administrative, fiscal and governmental tools and processes for maintaining and enhancing visual environmental quality.

LAR 575 Development Planning. *Preq.: Grad. standing or CI. 3(3-0) F,S.* The seminar presents the concepts, processes and principles used in the design and development of communities. The discussions will focus on a general development process, the development team and the role of the designer in the context of the team. A wide range of project types will be discussed. The seminar presents the relationships of public regulatory policies and programs to the community design and development process.

LAR 591 Special Seminar. *Preq.: Grad. standing. 1-3 F,S.* Seminars on subjects of current interest in design which are presented by persons not part of the regular faculty.

LAR 592 Special Topics. *Preq.: Grad. standing. 2-3 F,S.* Topics of current interest to the programs in the School of Design offered by faculty in the School. Subjects offered under this number are normally used to test and develop new courses.

LAR 595 Independent Study. *Preq.: Grad. standing. Max. 6. F,S,Sum.* Special problems in various aspects of design developed under the direction of a faculty member on a tutorial basis.

FOR GRADUATES ONLY

LAR 600 Landscape Design Studio. *Preq.: Grad. standing. 6(0-12) F,S.* The application of information and skills developed in course work to environmental design problems. A process of site selection, activity programming, site planning, and program evaluation is followed which employs the creation of interactive communication systems between the designer, clients and users. Goals include the design of satisfying new landscapes as well as conservation and design strategies for existing culturally important landscapes and townscapes.

LAR 611 Advanced Community Design and Development Control. *Preq.: LAR 511. 3(1-3) S.* Advanced work in design and application of governmental planning and development control techniques to built environments, and impact of such controls on design solutions at varying scales. Emphasis is on design implications of complex control systems: development rights transfer, land use intensity rating systems, planned unit development regulations and other zoning and non-zoning site planning regulations.

LAR 612 Social Factors Analysis in Site Planning. *Preq.: LAR 511 or CI. 3(2-1) S.* The course explores social factors techniques and research applications to the design of the landscape. Interaction, neighborhood theory and user preference analysis techniques will be presented through discussion and development of research and case studies.

LAR 691 Degree Seminar. *Preqs.: 3 LAR 600 studios. 0.* Each student in his or her terminal semester not registered in any other courses and in conjunction with the terminal case study will prepare and submit to his or her committee a presentation on the relevance of one's minor to the design process with particular reference to the individual's case study.

LAR 698 Advanced Research Projects. *Preqs.: 2 LAR 600 studios or CI. 2-6 F.S.* Graduate students sufficiently prepared may undertake selected research investigations. A proposal for such investigations must be submitted prior to consent for enrollment.

Management

Professor D. M. Holthausen Jr., Coordinator

Professors: R. H. Bernhard, W. Chou, S. E. Elmaghraby, D. W. Johnston, A. B. Moss; Associate Professors: S. E. Margolis, T. W. Reiland

The Master of Science in Management (MSM) degree emphasizes the application of quantitative techniques and economic analysis to management decision making. It is a young, innovative program, different in style and philosophy from most graduate management programs. The degree is offered jointly by seven academic departments: Economics and Business, Industrial Engineering, Operations Research, Statistics, Textiles, Civil Engineering and Computer Studies. The range of faculty expertise and courses available through these departments distinguishes the MSM from other graduate management programs and gives the MSM student considerable flexibility in choosing a set of courses to fit his or her background and interests.

Applicants must have two semesters of calculus and one semester each of intermediate microeconomics and macroeconomics as prerequisites for the program. A student should take most of these courses before applying for admission. Submission of the Graduate Management Admission Test (GMAT) or the Graduate Record Exam (GRE) is highly recommended but not required.

Undergraduate courses in accounting, computer science and statistics provide important background skills for the MSM program. Students must complete course work in financial and managerial accounting, introductory computer science (including some programming), and statistical methods (including regression and analysis of variance). A course in business or regulatory law is strongly recommended but not required. Students who have not completed these courses in recent undergraduate work should take them early in their graduate programs.

The MSM program requires 36 semester hours of graduate course work consisting of seven core courses required of all students and five courses to be chosen in a technical option.

The core courses are: Price Theory (EB 501), Income and Employment Theory (EB 502), Introduction to Operations Research (OR 501), Statistical Methods (usually satisfied by taking ST 512), Research Methods in Marketing (EB 513), Managerial Finance: Theory and Applications (EB 520), and one of the following: Long-Range Planning in Business and Industry (EB 625), Advanced Management Accounting (ACC 569) or Special Economics Topics—Human Resource Management (EB 590P).

The technical option consists of five advanced courses chosen by the student in consultation with his or her faculty advisors. Technical option courses may be from one or more of the seven cooperating departments and may also include courses from other departments in the University. This flexibility permits each student to tailor a specialization to fit his or her background and career goals. Depending on the set of courses chosen, additional prerequisites may be required.

A few examples of the many courses available are listed below:

Economics and Business

- EB 522 Portfolio and Capital Market Theory
- EB 525 Managerial Economics
- EB 650 Economic Decision Theory

Civil Engineering

- CE 561 Construction Planning and Scheduling
- CE 562 Construction Productivity
- CE 665 Construction Equipment Systems

Computer Studies

- CSE (CSC,ECE) 501 Design of Systems Programs
- CSE 505 Design and Analysis of Algorithms
- CSE (CSC,ECE) 510 Software Engineering

Industrial Engineering

- IE 511 Capital Investment Economic Analysis
- IE 523 Production Planning, Scheduling and Inventory Control
- IE 525 Organizational Planning and Control

Operations Research

- OR (IE,MA) 505 Linear Programming
- OR (IE) 509 Dynamic Programming
- OR (CSC,CSE,ECE,IE) 562 Computer Simulation Techniques

Statistics

- ST 517 Applied Least Squares
- ST 519 Applied Multivariate Statistical Analysis
- ST 613 Time Series Analysis: Time Domain

*Textiles***TX 585 Market Research in Textiles****TX 680 Special Projects in Textile Management****TX 687 Competitive Strategy and Planning for the Textile Firm**

A project paper and a final oral examination are required of each student. The project paper is usually written in conjunction with one of the 600-level courses and often involves an analysis of a problem faced by a local business firm. Defense of the paper constitutes the basis for the final oral examination that is conducted by the student's graduate advisory committee.

Selected courses are offered in the evening on a rotating basis for students who choose part-time study. Approximately half of the students currently in the program have taken this route. However, not all courses or technical options are available during the evening, and you should check with the Department of Economics and Business for further information on part-time study.

Computer facilities are accessible to students for use in class assignments and research projects. The Department of Economics and Business maintains a computer lab with a number of IBM-PCs and software packages for word processing, database management, spreadsheet analysis, statistics, operations research and other management applications. The department also employs a staff of programmers who can be consulted by computer users.

A wide range of employers have found the analytical nature of the MSM program to be very attractive. Recent graduates have been employed by many firms, governmental agencies and nonprofit institutions in North Carolina and other states. The services of the University's Career Planning and Placement Center are available to all students. In addition, the Department of Economics and Business employs a placement counselor to serve its current students and recent graduates, including those in the MSM program.

For additional information, contact Information Officer, Department of Economics and Business, Box 8109, North Carolina State University, Raleigh, NC 27695-8109, phone (919) 737-3273, or any member of the Graduate Faculty.

Marine, Earth and Atmospheric Sciences

GRADUATE FACULTY

Professor L. J. Langfelder, Head

Professor G. S. Janowitz, Graduate Administrator

Professors: S. P. S. Arya, G. Briggs, H. S. Brown, V. V. Cavaroc Jr., J. M. Davis, L. J. Pietrafesa, W. J. Saucier, C. W. Welby, T. G. Wolcott; *Professors Emeriti:* C. J. Leith, J. M. Parker III; *Associate Professors:* D. J. DeMaster, R. V. Fodor, C. D. Harrington, D. Kamykowski, M. M. Kimberley, C. E. Knowles, C. A. Nittrouer, A. J. Riordan, V. K. Saxena, S. SethuRaman, E. F. Stoddard, G. F. Watson, R. H. Weisberg, I. J. Won; *Adjunct Associate Professors:* F. S. Binkowski, J. K. Ching, R. E. Eskridge; *Assistant Professors:* M. G. Bevis, N. E. Blair, M.

DeMaria, L. A. Levin, W. J. Showers; *Visiting Assistant Professors*: V. R. Lamb, A. P. S. Reymer; *Adjunct Assistant Professor*: T. B. Curtin

ASSOCIATE MEMBERS OF THE DEPARTMENT

Professors: M. Amein, B. J. Copeland, F. Y. Sorrell Jr., C. C. Tung; *Associate Professor*: J. M. Miller

The Department of Marine, Earth and Atmospheric Sciences offers graduate programs leading to the M.S. and Ph.D. degrees.

The Atmospheric Science areas of specialization include atmospheric dispersion, boundary layer flows and air quality; synoptic weather systems and weather forecasting; climatology and agricultural meteorology; and cloud and aerosol physics.

Areas of specialization in Earth Science include mineralogy, igneous and metamorphic petrology, sedimentology and sedimentary petrology, sedimentary geochemistry, economic geology, global and exploration geophysics, structural geology, hydrogeology and geomorphology. As geology and geophysics are considered distinct areas of study, students can major in one area and minor in the other.

In Marine Science, areas of specialization are biological, chemical, geological and physical oceanography, geophysical fluid dynamics and marine meteorology.

Admission with a specialization in Atmospheric Science requires a bachelor's degree in meteorology or other technical areas which include a background in chemistry, physics and mathematics. Candidates in Earth Science should hold a bachelor's degree in geology or a satisfactory equivalent, preferably with a strong background in physics, chemistry and mathematics. Graduate students in Marine Science are normally admitted after having received a baccalaureate degree in biology, chemistry, engineering, geology, mathematics, physics or meteorology.

In each discipline the master's program includes a minimum of 30 semester credit hours. Doctoral programs normally contain at least 50 semester credit hours beyond the B.S. degree, although course requirements are determined by the student's advisory committee. Graduate work includes major and minor fields and a research thesis. An M.S., non-thesis option is also available. Marine Science students are expected to be familiar with areas of marine studies other than their own and are required to complete two (three) courses from other Marine Science core areas in the M.S. (Ph.D.) program.

Sponsored research is being conducted in various areas of geology and geophysics, in air pollution and boundary layer meteorology, cloud and aerosol physics, and in Marine Science, in continental shelf, Gulf Stream and equatorial dynamics, geophysical fluid dynamics, sediment transport and water column and benthic biology. Graduate students are actively involved in the conduct of the research which often forms the basis of their theses. Research projects range from theoretical studies to international field experiments. Regional studies are being performed within the North Carolina Blue Ridge, Piedmont and Coastal Plain as well as in estuaries, on the continental shelf and slope and in equatorial regions.

Research facilities are available for analytical work in most areas of geology, geophysics and atmospheric sciences. Biological, chemical, geological and physical oceanography laboratories and shop facilities for electronic and mechanical equipment repair and fabrication are available for student use. Students also have on-campus access to the TUCC IBM System 370/165 and Amdahl computers and to several smaller computing facilities operated by the department. Remote sensing capabilities are utilized in both research and classroom instruction. Collections of pertinent literature are available in the University library and elsewhere in the Research Triangle area. Consultation with scientists of the federal and state agencies in Raleigh as well as with the staffs of the neighboring universities is possible and encouraged.

The State of North Carolina operates three Marine Resources Centers on our coast where research space is available. Our students have also made use of facilities at Duke University's Marine Laboratory and the National Marine Fisheries Laboratory, both on Pivers Island, North Carolina. The department has a small boat and is a member of the Duke/UNC consortium that operates the new 131 ft. R/V Cape Hatteras.

Financial aid is available through both teaching assistantships (9 month) and research assistantships (9 or 12 month). Government agencies and industry occasionally provide part-time employment and small grants from the State are sometimes available to assist with thesis expenses.

Atmospheric Science

SELECTED ADVANCED UNDERGRADUATE COURSES

- MEA 412 Atmospheric Physics.** *Preqs.: MA 202, PY 208 or equiv. 3(3-0) S.*
- MEA 421 Air Processes and Motions I.** *Preqs.: MA 202, PY 208, MEA 311, 312, 313, 314. 4(3-2) F.*
- MEA 422 Air Processes and Motions II.** *Preq.: MEA 421. 4(3-2) S.*
- MEA 443 Weather Analysis and Forecasting I.** *Preq.: MEA 421. 3(1-6) F.*
- MEA 444 Weather Forecasting Principles.** *Preq.: MEA 443. 3(2-3) F.*
- MEA 455 Micrometeorology.** *Preq.: MEA 422 or MAE 402. 3(3-0) F.*
- MEA 493 Special Topics in Meteorology.** *Preq.: Consent of department. 1-3 F,S,Sum.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

MEA 512 Satellite Meteorology. *Preq.: MA 202; Coreq.: MEA 443. 3(3-0) S. Alt. yrs.* Basic background in satellite orbits, coordinate systems and image navigation; description of sensors and techniques for quantitative measurement of atmospheric variables. Applications of satellite data in analysis of weather systems; evolution of convective systems, tropical disturbances and mid-latitude cyclones as revealed by visible and infrared imagery; current research in satellite applications. Riordan

MEA 521 The Upper Atmosphere. *Preq.: MEA 311 or CI. 3(3-0) S,Sum.* Meteorological conditions in the upper atmosphere from the stratosphere to the ionosphere. Compositions,

mean distributions and variability, circulation and transport properties in the region.
Physical theories. Graduate Staff

MEA 524 Dynamic Meteorology. *Preq.: MEA 422 or equivalent. 3(3-0) F.* A brief review of the classical and physical hydrodynamics; scale analysis of dynamic equations; atmospheric instabilities; dynamics of tropical convections; perturbation theory and approximations for atmospheric wave motions. Graduate Staff

MEA 525 Numerical Weather Prediction. *Preqs.: MEA 524, CSC (MA) 427 or equivalent and some FORTRAN programming experience. 3(3-0) F,S. Alt. yrs.* Physical and mathematical basis of numerical weather prediction with computer experiments to demonstrate principles and techniques. Topics include derivation of sets of prediction equations consistent with scale analysis and dynamical constraints; atmospheric waves and filtered equations; numerical methods and computational instabilities; filtered and primitive equation models; NWS operational models. Watson

MEA 526 Air-Sea Interaction. *Preq.: MEA 422 or MEA 560 or CI. 3(3-0) S. Alt. yrs.* Review of basic equations and concepts of turbulent transfer in geophysical flows, air-sea interaction processes and their importance to man's activities, theory and observation of wind-generated ocean surface waves, turbulent transfers in the planetary boundary layer of the marine atmosphere, oceanic mixed layer, development of thermocline and inversion. SethuRaman

MEA 527 Planetary Boundary Layer. *Preq.: MEA 455 or MEA 526 or CI. 3(3-0) F,S. Alt. yrs.* Review of the basic equations and concepts of planetary boundary layers. Study of the closure problem and semi-empirical theories of turbulence, buoyancy effects on mean flow and turbulence, instrumentation and observational platforms for PBL experiments, observed characteristics of atmospheric boundary layers, numerical and physical modeling of PBL and its parameterization in large-scale atmospheric circulation models. Arya

MEA 555 Meteorology of the Biosphere. *Preqs.: PY 205 or 211; CH 103 or 107; MA 102 or 112. 3(3-0) F.* A course designed for graduate students in the life sciences, presenting the physical principles governing the states and processes of the atmosphere in contact with earth's surface of land, water and life. Exchanges of heat, mass and momentum are analyzed for various conditions of the atmosphere and surface and as a function of season, time and geographic location. Davis

MEA 556 Air Pollution Meteorology. *Preqs.: MA 201 or 212, PY 208 or 212, CH 103 or 105 or 107 or equivalent. 3(3-0) F.* Wind structure in the atmospheric surface layer and planetary boundary layer; temperature structure and stability; mixed layer and inversions; turbulence intensity and scale; meteorological factors affecting the dispersion of pollutants; diffusion theories and models; diffusion and transport experiments; plume rise, fumigation and trapping; removal processes; effects of buildings and hills; effects of local winds. Arya

MEA 557 Advanced Cloud and Precipitation Physics. *Preq.: MEA 421 or MEA 412. 3(3-0) F. Alt. yrs.* An analysis of the microstructure of warm and cold clouds and precipitation, cloud microphysics-dynamics interactions, formation of cloud droplets, growth of cloud droplets by condensation, initiation of rain in nonfreezing clouds, formation and growth of ice crystals, precipitation theories, planned and inadvertent weather modification and the problem of acid rain. Saxena

MEA 558 Atmospheric Aerosols. *Preqs.: CH 103 or 107 and PY 205 or 211; Coreq.: MEA 412. 3(3-0) S. Alt. yrs.* An understanding of aerosols as primary air pollutants, indoor versus outdoor pollution, transformation processes, prediction of atmospheric concentrations, scavenging of aerosols, transport of air pollutants on a regional scale, discussion of national experiments to characterize and study the impact of urban-industrial pollution, tropospheric aerosol and weather, stratospheric aerosol, effect of aerosols on atmospheric warming and cooling and air-quality models. Saxena

MEA 593 Special Topics. *Preq.: CI 1-6 F,S,Sum.* Special topics in meteorology, provided to groups or to individuals. Graduate Staff

FOR GRADUATES ONLY

MEA 614 Atmospheric Radiative Transfer. *Preq.: MEA 412. 3(3-0) S.* The study of solar and terrestrial radiation. Methods of actinometric measurements, radiation absorption in the atmosphere, scattering of radiation, the solar spectrum, infrared radiative transfer and methods of determining net radiation. Satellite measurement of radiation and determination of atmospheric properties from satellite measurements. Saxena

MEA 627 Atmospheric Turbulence and Diffusion. *Preq.: MEA 422. 3(3-0) F.* Mechanics of turbulence in the atmosphere, spectra and scales of atmospheric turbulence and magnitudes of turbulent fluctuations. Theories of diffusion in the atmosphere. Diffusion and transport experiments. Processes other than natural turbulence affecting concentration of effluents. Arya

MEA 635 Dynamical Analysis of the Atmosphere. *Preqs.: MEA 441, 443. 3(2-3) F.* Theory and analysis of circulation and weather systems based on dynamical concepts; structure, movement and development of systems; evaluation of theoretical concepts in prognosis and forecasting. Saucier

MEA 695 Seminar. *Preq.: Grad. standing. 1(1-0) F,S.* Presentation of scientific articles and special lectures. Each student is required to present or critically review one or more papers. Graduate Staff

MEA 699 Research. *Preqs.: Grad. standing and consent of advisory committee. Credits Arranged. F,S.* Graduate research in fulfillment of requirements for a graduate degree. Graduate Staff

Earth Science

SELECTED ADVANCED UNDERGRADUATE COURSES

MEA 415 Geology of Metalliferous Deposits. *Preqs.: MEA 440, MEA 452. 3(2-3) S.*

MEA 423 Invertebrate Paleontology and Biostratigraphy. *Preqs.: MEA 201/210 or ZO 202. 4(3-3) F.*

MEA 440 Igneous and Metamorphic Petrology. *Preq.: MEA 331. 4(3-3) F.*

MEA 452 Sedimentary Petrology and Stratigraphy. *Coreq.: MEA 331. 4(3-3) S.*

MEA 461 Engineering Geology. *Preq.: MEA 101 or 120. 3(3-0) F.*

MEA 465 Geologic Field Camp I. *Preqs.: MEA 351, 440, 452. First part of 6 weeks out-of-state summer field camp. Both MEA 465 and 466 must be taken in the same summer. 3 Sum.*

MEA 466 Geologic Field Camp II. *Preq.: MEA 465. Second part of 6 weeks out-of-state summer field camp. Both MEA 465 and 466 must be taken in the same summer. 3 Sum.*

MEA 470 Principles of Geophysics. *Preqs.: PY 208 or 212; MEA 120 or equivalent recommended. 3(3-0) F.*

MEA 471 Exploration and Engineering Geophysics. *Preq.: MEA 470 or PY 208. Credit may not be received for both MEA 471 and MEA 570. 3(3-0) F.*

MEA 475 Geophysical Field Methods. *Preq.: MEA 471. Credit is not allowed for both MEA 475 and MEA 575. 2 cr. Sum. field camp.*

MEA 476 Seismic Exploration for Oil. *Preqs.: PY 208, knowledge of FORTRAN. Credit is not allowed for both MEA 476 and MEA 576. 3(3-0) S.*

MEA 481 Principles of Geomorphology. *Preq.: MEA 201 or equivalent. 3(2-2) F.*

MEA 491 Seminar on Selected Geologic Topics. 1-3 F.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

MEA 500 Regional Geology of North America. *Preqs.: MEA 101 or 120, sr. standing. 1-6 F.S.* Field study of classic geologic localities and geomorphic processes not indigenous to North Carolina. Typical areas are New England and adjacent Canada, northern Mexico and southwestern United States and the Pacific Northwest. Representative subjects include the Canadian Shield, Precambrian mineral deposits, the San Andreas fault, desert geomorphology, Grand Canyon stratigraphy, modern and ancient reefs and glaciated volcanoes. Mineral, rock and fossil collecting. Student reports required. Graduate Staff

MEA 510 Geological Oceanography. *Preq.: MEA 452 or equivalent. 3(3-0) F.* A comprehensive overview of the geological aspects of oceanography. Topics include: a) marine geophysics and the evolution of ocean basins, b) sedimentological processes and the formation of marine deposits, c) marine geochemistry and authigenic sedimentation, d) paleoceanography and the interpretation of marine stratigraphy. Nittrouer

MEA 515 Topics in Southern Appalachian Geology. *Preqs.: MEA 351 and MEA 440 or equivalent. 3(3-0) F. Alt. yrs.* Examination of the geology of North Carolina and surrounding areas. Lectures, discussions, reading of and review of current literature and consideration of ideas concerning the geological evolution of the area. A term project on a selected topic is required. Required field trips. Stoddard

MEA 522 Petroleum Geology. *Preq.: MEA 452. 3(3-0) S. Alt. yrs.* Properties, origin and modes of occurrence of petroleum and natural gas. Geologic and economic features of the principal oil and gas fields, mainly in the United States. Graduate Staff

MEA 523 Introduction to Subsurface Well Evaluation. *Preqs.: CH 103, PY 212, MEA 120. 3(2-3) F. Alt. yrs.* Principles, uses and interpretation of commonly used wireline technique for structural, lithologic and fluid evaluation of wells. Oriented towards petroleum reserve/evaluations. Cavaroc

MEA 532 Ore Microscopy. *Preq.: MEA 331. 3(0-6) F. Alt. yrs.* The theory and technique of microscopic investigation of opaque ore minerals, ores and mill products produced by beneficiation of ores. Studies of compositions and textures of materials in polished surfaces are based on observations of optical and physical properties, etch reactions and microchemical tests. (Offered F 1985 and alt. years.) Brown

MEA 542 Intermediate Petrographic Analysis. *Preq.: MEA 440 or equivalent. 2(0-5) F.* Systematic study of rocks in thin section by means of the petrographic microscope. Mineralogy, mineral and rock compositions and rock textures applied to an interpretation of the origin and crystallization or depositional history of specimens studied. Suites representative of each of the three major rock groups will be studied during the first half of the semester; during the remainder of the semester, the student will concentrate on suites representative of his/her area of specialization. Cavaroc, Stoddard

MEA 545 Advanced Igneous Petrology. *Preq.: MEA 440. 3(2-2) S. Alt. yrs.* Physicochemical principles related to igneous petrogenesis. General principles and specific problems including the origin, differentiation and emplacement of magmas and the possible relationships of igneous processes to global tectonics. Fodor

MEA 546 Advanced Metamorphic Petrology. *Preq.: MEA 440. 3(2-2) S. Alt. yrs.* The petrogenesis of metamorphic rocks including conditions of metamorphism, metamorphic facies and facies series, the petrogenetic grid, contact and regional metamorphism, metamorphism and plate tectonics. Heterogeneous chemical equilibrium and application of Gibbs Phase Rule to metamorphic rocks. Thermodynamically valid algebraic and graphical analysis of equilibrium mineral assemblages. Chemical zoning. Petrographic studies of selected metamorphic suites. Stoddard

MEA 551 Advanced Structural Geology. *Preq.: MEA 351. 3(2-3) F. Alt. yrs.* Principles of rock mechanics and their application in solving geologic problems; finite strain analysis of deformed rocks; advanced techniques of structural analysis; petrofabrics; development of various geologic structures. Course is designed to emphasize the application of principles and techniques in the field. Reymer

MEA 562 Applied Sedimentary Analysis. *Preqs.: MEA 452, ST 361. 3(2-2) F. Alt. yrs.* Extension of MEA 452, with emphasis on coarser grained clastic sedimentary rocks. Sampling of sedimentary population, critical study of assumptions underlying standard measurement techniques; treatment, testing and evaluation of sedimentary data; application to problems in sedimentology. Cavaroc

MEA 564 Depositional Environments and Lithostratigraphy. *Preq.: MEA 452 or grad. standing. 3(2-3) S.* Fabric of large sedimentary basins in terms of the spatial distribution of component major rock facies; current litho-genetic models based upon comparison with recent equivalents; field trips. Cavaroc

MEA 565 Hydrogeology. *Preq.: MEA 452. 3(3-0) S. Alt. yrs.* Occurrence and sources of surface and subsurface water. Relationships of surface water to subsurface water. Rock properties affecting infiltration, movement, lateral and vertical distribution and quality of ground water. Determination of permeability, capacity, specific yield and other hydraulic characteristics of aquifers. Principles of well design, legal aspects of water supplies. Welby

MEA 566 Hydrogeology of Groundwater Pollution and Protection. *Preq.: MEA 565 or CE 543 or equivalent. 3(3-0) S. Alt. yrs.* Hydrogeologic factors associated with protection of groundwater; use of geologic principles and materials to protect groundwater quality; geologic evaluation and monitoring of waste disposal sites, including appropriate models. Welby

MEA 567 Geochemistry. *Preq.: CH 331 or 433. 3(3-0) F. Alt. yrs.* The quantitative distribution of elements in the earth's crust, the hydrosphere and the atmosphere. Application of the laws of chemical equilibrium and resultant chemical reactions to natural earth systems. Geochemical application of Eh-pH diagrams. Geochemical cycles. Isotope geochemistry. Kimberley

MEA 570 Exploration and Engineering Geophysics. *Preq.: MEA 470 or PY 208. 3(3-0) S.* Geophysical methods as applied to exploring the earth's mineral and energy resources and to investigating subsurface geological structure and physical properties. Principles, measurements, analyses, and interpretations of gravity, magnetic, electric, electromagnetic, seismic methods. Research paper required. Won

MEA 572 Laboratory and Field Methods for Investigation of the Seabed. *Preqs.: MEA 510 or CH 107 or MEA 571. 3(2-3) S. Alt. yrs.* An initial lecture and laboratory phase acquaints the student with the use of advanced techniques and instrumentation for chemical

and geological oceanographic investigations. A field project in the the coastal waters of North Carolina and then allows application of these tools to a specific marine problem.

DeMaster, Nittrouer

MEA 575 Geophysical Field Methods. *Preq.: MEA 570. 2(2-week summer camp) Sum. Alt. yrs.* Two-week summer field course. Practical geophysical field measurements using instruments for gravity, magnetic, electric, electromagnetic and radioactivity methods. Data interpretation in terms of subsurface geological structures and their physical properties, locations, sizes and shapes. Students are required to register for the course in the second summer session. Location: within the state of North Carolina. Estimated expense: \$150.00. Research paper required. Won

MEA 576 Seismic Explortion for Oil. *Preqs.: PY 208 and knowledge of FORTRAN language. 3(3-0) S.* A comprehensive introduction to the reflection seismic method as applied to exploring oil and gas resources. Seismic instrumentation, field data acquisition, common-depth-point method, deconvolution, digital filtering, migration and seismic stratigraphy of hydrocarbon depositional environments, along with computer-oriented exercises. Research paper required. Won

MEA 577 Sedimentary Geochemistry. *Preq.: CH 331 or CH 431 or MEA 567 or equivalent background. 3(3-0) S. Alt. yrs.* This course applies thermodynamic data to the calculation of reactions in natural waters at or near the earth's surface. Topics include weathering to form clay minerals, precipitation of economic minerals and carbonate sedimentology.

Kimberley

MEA 580 Remote Sensing. *Preq.: FOR 353 or CE 507 or MEA 481 or equivalent background. 3(2-1) F.* The course introduces the student to the principles and use of various remote sensing techniques such as satellite imaging, thermal scanning, side-looking airborne radar (SLAR) and multispectral aerial photography. Each student concentrates his attention in the problem sessions upon utilization of the various sensors in his own discipline.

Welby

MEA 581 Advanced Geomorphology. *Preq.: MEA 481 or other equivalent background. 3(2-3) S. Alt. yrs.* The application of quantitative techniques to the study of the geologic processes responsible for the formation and modification of land forms. Analysis of processes and landforms related to drainage basins, and regions of karst, glacial and coastal geomorphology. Emphasis on geomorphic areas in North Carolina. Field trips. Harrington

MEA 582 Quaternary Geology. *Preqs.: MEA 101 or 120, sr. standing. 3(3-0) S. Alt. yrs.* Glaciology, glacial geology, Pleistocene stratigraphy, periglacial geomorphology; Quaternary volcanism, tectonism and sea-level fluctuations; late Cenozoic climate changes; field trips.

Harrington

MEA 583 Photogeology. *Preq.: MEA 101 or 120. 3(2-2) S.* The stereoscopic study of aerial photographs to obtain geologic information. The construction of bedrock and surficial geologic maps from aerial photographs. Aspects of remote sensing useful in geological interpretation.

Harrington

MEA 588 Regional Tectonics. *Preqs.: MEA 351, 440, 452. 3(3-0) S. Alt. yrs.* Methods of study of the tectonic history of major geologic regions in North America and other areas of the world through the application of stratigraphy, petrology and structural geology. Synthesizing regional tectonic patterns and events.

Graduate Staff

MEA 593 Special Topics. *Preq.: CI. 1-6 F,S.* Special study of some advanced phases of geology.

Graduate Staff

MEA 598 Advanced Topics in Geophysics. *Preq.: CI. 1-6 F,S,Sum.* Special study of some advanced phases
Graduate Staff

FOR GRADUATES ONLY

MEA 610 Marine Sedimentology. *Preq.: MEA 510. 3(3-0) S. Alt. yrs.* A quantitative examination of sedimentology with specific reference to the marine environment including an introduction to fluid mechanics, sediment transport theory, quantitative models of sedimentation and dynamic stratigraphy.
Nittrouer

MEA 611, 612 Advanced Economic Geology. *Preqs.: MEA 440, 452. 3(3-0) F,S.* Detailed study of the origin and economic occurrence of specific mineral deposits.
Brown

MEA 630 Geotectonics. *Preqs.: MEA 351, 440, 452. 3(3-0) F. Alt. yrs.* In-depth examination of current ideas in plate tectonic theory. Plate tectonic controls on orogeny, orogenic belts, magmatism and metallogeny.
Bevis, Reymer

MEA 670 Advanced Geophysics I. *Preqs.: MEA 570 and MA 401. 3(3-0) F. Alt. yrs.* Advanced geophysical theories and applications: topics chosen from the potential field theory of Laplace and Poisson, gravity, heatflow, magnetism, electric and electromagnetic fields as means of investigating the earth's internal structure. Understanding geodynamic principles and applications to exploring for mineral and hydrocarbon resources.
Bevis

MEA 671 Advanced Geophysics II. *Preqs.: MEA 570 and MA 401. 3(3-0) F. Alt. yrs.* Advanced geophysical theories and applications: topics chosen from scalar and vector wave propagation phenomena in geophysics, earthquake seismology, focal mechanisms, propagation of body and surface waves, plate tectonics, advanced reflection seismology for oil and gas exploration, electromagnetic waves as applied to mineral exploration.
Won

MEA 695 Seminar. *Preq.: Grad. standing. 1(1-0) F,S.* Scientific articles, progress reports and special problems of interest to geologists and geological and mining engineers discussed.
Graduate Staff

MEA 698 Geophysical Research. *Preq.: CI. Credits arranged. F,S,Sum.* Thesis research in geophysics.
Graduate Staff

MEA 699 Research. *Preq.: CI. Credits Arranged. F,S,Sum.* Lectures reading assignments and reports; special work in geology to meet the needs and interests of the students. Thesis problem.
Graduate Staff

Marine Science

FOR GRADUATES AND ADVANCED UNDERGRADUATES

MEA 501 Environmental Fluid Mechanics. *Preqs.: MA 202, PY 208. 3(3-1) F.* Basic concepts and the laws governing the motion of the atmosphere and oceans are developed from first principles, including approximations valid for environmental flows, the kinematics, dynamics and thermodynamics of fluid flows as well as an introduction to environmental turbulence.
Graduate Staff

MEA 510 Geological Oceanography. *Preq.: MEA 452 or equivalent. 3(3-0) F.* A comprehensive overview of the geological aspects of oceanography. Topics include: a) marine geophysics and the evolution of ocean basins, b) sedimentological processes and the formation of marine deposits, c) marine geochemistry and authigenic sedimentation, d) paleoceanography and the interpretation of marine stratigraphy.
Nittrouer

MEA (ZO) 520 Principles of Biological Oceanography. *Preqs.: BS 100 and either BO (ZO) 360 or grad standing. 3(3-0) S.* Biological productivity and trophic relationships in Plankton, Nekton and Benthos; community ecology of selected habitats (estuaries, intertidal zones, coral reefs, deep sea) and adaptation of organisms to the marine environment.

Wolcott

MEA 526 Air-Sea Interaction. *Preq.: MEA 422 or MEA 560 or CI. 3(3-0) S. Alt. yrs.* Review of basic equations and concepts of turbulent transfer in geophysical flows, air-sea interaction processes and their importance to man's activities, theory and observation of wind-generated ocean surface waves, turbulent transfers in the planetary boundary layer of the marine atmosphere, oceanic mixed layer, development of thermocline and inversion.

SethuRaman

MEA (ZO) 534 Marine Benthic Ecology. *Preqs.: ZO 302, ZO 509 or ZO 517 or MEA (ZO) 520. 3(3-0) S. Alt. yrs.* Marine benthic systems in the deep sea and in shallow waters, focusing upon the abiotic and biotic processes which regulate density, diversity and taxonomic and functional composition. Discussions of benthic-pelagic coupling, predation, interspecific competition, biogeography, sampling problems, evolutionary trends, trophic structure and community organization.

Levin

MEA (CE) 541 Gravity Wave Theory I. *Preq.: MAE 308 or PY 411. 3(3-0) S.* Classical gravity wave theory with emphasis on the basic mechanics of wave motions, mass transport induced by waves and various conservation laws with their applications in wave study.

Weisberg

MEA 560 Principles of Physical Oceanography. *Preqs.: MA 212 and PY 212 or equivalent. 3(3-0) S.* An introduction to the principles and practice of physical oceanography. Subjects to be covered include: the equation of state of seawater; energy transfer to the ocean by thermal, radiative and mechanical processes; the heat budget; oceanic boundary conditions; the geographical distribution of oceanic properties; observational methods; conservation equations; simple waves and tides; physical oceanography of the North Carolina coastal zone.

Knowles

MEA 561 Introduction to Physical Oceanography. *Preqs.: MA 301, PY 208 or CI. 3(3-0) F.* An introduction to the descriptive and dynamical features of ocean circulation. Topics to be covered include the physical properties of seawater, oceanic heat budget, fluid mechanics, dynamics of ocean currents, descriptive oceanography, tides and other waves.

Morrison

MEA (MAE) 563 Geophysical Fluid Mechanics. *Preq.: MAE 550 or equivalent. 3(3-0) F. Alt. yrs.* The principles of fluid mechanics are applied to geophysical systems. Special emphasis is placed on those features of these systems, such as almost rigid rotation and stable stratification, which produce unique and important effects. The effects of almost rigid rotations on homogeneous and stratified flows are examined in detail.

Janowitz

MEA 568 Ocean Circulation. *Preq.: MAE 308 or PY 411. 3(3-0) F.* Basic study of the mechanics of ocean circulation with emphasis on various simple models of circulation systems.

Pietrafesa

MEA 569 The Physical Dynamics of Estuaries. *Preqs.: MA 202 or 212; PY 208 or 212 or CI. 3(3-0) S. Alt. yrs.* A physical/dynamical description of estuaries and estuarine processes which occur as a function of tides, atmospheric forcing, river runoff and topography. Includes classification schemes; the development of salt, heat energy and momentum balances; a discussion of geological modeling and sediment transport processes as a function of the physical dynamics; conservative and non-conservative pollution dispersion prediction; and the theoretical, mathematical modeling of estuaries, including those in North Carolina.

Pietrafesa

MEA 571 Principles of Chemical Oceanography. *Preq.: CH 107 or equivalent. 3(3-0) F.* Chemical processes which control the composition of the oceans, including discussions of chemical equilibria, biological cycling of nutrients and the use of chemical tracers in the marine environment; the origin and chemical history of the oceans are also considered.

DeMaster

MEA 572 Laboratory and Field Methods for Investigation of the Seabed. *Preqs.: MEA 510 and CH 107 or MEA 571. 3(2-3) S. Alt. yrs.* An initial lecture and laboratory phase acquaints students with the use of advanced techniques and instrumentation for chemical and geological oceanographic investigations. A field project in the coastal waters of North Carolina then allows application of these tools to a specific marine problem.

DeMaster, Nittrouer

MEA 591, 592 Seminar. *1(1-0) S.* A seminar designed to give perspective in the field of marine science. Topics vary from semester to semester. In order to obtain credit a student must deliver a seminar.

Graduate Staff

MEA 593 Special Topics. *Preq.: CI. 1-3 F,S.* This course provides the opportunity for advanced undergraduate and graduate students to study timely special problem areas in marine science and engineering.

Graduate Staff

FOR GRADUATES ONLY

MEA 610 Marine Sedimentology. *Preq.: MEA 510. 3(3-0) S. Alt. yrs.* A quantitative examination of sedimentology with specific reference to the marine environment including an introduction to fluid mechanics, sediment transport theory, quantitative models of sedimentation and dynamic stratigraphy.

Nittrouer

MEA 613 Continental Margin Sedimentation. *Preq.: MEA 510. 3(3-0) S. Alt. yrs.* A detailed examination of the processes and sedimentation active along continental margins. The specific environments explored are the continental shelf, slope and rise.

Nittrouer

MEA 622 Marine Plankton Ecology. *Preqs.: BCH 451 and MA 212 and ZO 419 or equivalents. 3(3-0) F. Alt. yrs.* This course will examine the worldwide relationships between the physical-chemical environment and planktonic organisms. Topics include organism descriptions; the effects of light, temperature, salinity, density, water motion and chemical constituents on organisms; interactions among different organisms emphasizing competition and predation; community structure, distribution and succession; and mathematics models of distribution, production and interaction.

Kamykowski

MEA (ZO) 623 Advances in Marine Community Ecology. *Preqs.: ZO 302 and ZO 517 or ZO 560 or MEA (ZO) 534. 3(3-0) S. Alt. yrs.* Current research and biological and physical processes structuring shallow and deep water benthic communities. Recent research on competition, predation, disturbance, succession, animal-sediment-flow interactions, life history tactics and experimental design in marine benthic biology. Student discussion of current issues and critique of recent papers.

Levin

MEA (ZO) 624 Ecology of Fishes. *Preq.: BO (ZO) 360 or 560 or equivalent. 3(3-0) F.* Physiological ecology of fishes emphasizing energetics, production and adaptations to aquatic mediums. Ecological classification of fishes and theory of resource partitioning in freshwater, estuarine and marine realms.

Miller

MEA (MAE) 663 Advanced Geophysical Fluid Mechanics. *Preq.: MAE 550 or equivalent. 3(3-0) S. Alt. yrs.* The principles of fluid mechanics are applied to geophysical systems. Special emphasis is placed on the role of stable stratification on the flows in these systems. The generation, interaction, propagation and dissipation of internal gravity waves are studied in detail. Other geophysically important flows are also studied.

Janowitz

MEA (MAE) 664, 665 Perturbation Method in Fluid Mechanics I, II. *Preqs.: MA 401, MAE 308, 3(3-0) F.S.* Basic theory and application of perturbation methods in fluid mechanics including: regular and singular perturbations, matching principles, method of strained coordinate, two variable expansion and applications to partial differential equations. (Offered 1984-85 and alt. years.)
Janowitz

MEA 674 Marine Geochemistry. *Preqs.: CH 331, MEA 571 or equivalent. 3(3-0) S. Alt. yrs.* A detailed examination of the chemical processes occurring in the marine environment. Topics discussed include: chemical evolution of the oceans, continental and submarine weathering, particle scavenging of reactive elements from the water, column, formation of biogenic and metalliferous deposits, sediment diagenesis and marine geochronology.
DeMaster

MEA 693 Advanced Special Topics. *Preqs.: Grad. standing and CI. 1-3.* This course will provide the opportunity for advanced graduate students to study in special problem areas in marine sciences. Various areas in the program may use this course concurrently in their areas.
Graduate Staff

MEA 699 Research. *Preqs.: Grad. standing and consent of advisory committee. Credits Arranged. F.S.*
Graduate Staff

Materials Engineering

GRADUATE FACULTY

Professor J. J. Hren, Head

Professor, A. A. Fahmy, Graduate Administrator

Professors: J. R. Beeler Jr., R. B. Benson Jr., H. Conrad, R. F. Davis, C. C. Koch, K. L. Moazed, J. Narayan, H. Palmour III, G. A. Rozgonyi, R. O. Scattergood, H. H. Stadelmaier; Adjunct Professors: C. R. Manning Jr., G. Mayer; Professors Emeriti: W. W. Austin, J. K. Magor, R. F. Stoops; Adjunct Associate Professor: J. C. Hurt; Associate Professor Emeritus: J. V. Hamme; Assistant Professors: C. M. Balik, N. A. El-Masry, R. L. Porter; Adjunct Assistant Professor: P. A. Parrish

The Department of Materials Engineering offers graduate programs leading to the degrees of Master of Science, Master of Materials Engineering and Doctor of Philosophy. Students with appropriate backgrounds in engineering, chemistry or physics can be accommodated, although most students enter the program with degrees in a materials-related discipline. Financial aid is available on a competitive basis to qualified students.

Graduate students in materials engineering are involved with academic studies and research programs that focus on understanding the structure, structure modification and properties of materials. Included is the development of new or improved materials and advanced processing methods, which are critical links between the design and the realization of new systems. Materials and materials limitations pervade all of the engineering and high technology fields that are an integral part of our society. The challenges and opportunities for graduates in materials engineering are exceptional.

Research in the department comprises a wide range of programs that deal with physical, chemical and mechanical behavior involving both bulk and surface phenomena in metals, ceramics, polymers and composites. There are rapidly growing activities in the areas of microelectronic materials, advanced processing methods for metals and ceramics, non-equilibrium structures and surface modification processes. The research programs are supported by state-of-the-art facilities for preparation, processing and characterization of materials. An ion-beam microprobe, analytical scanning-transmission microscopy and VAX-based computer facility are among the recent acquisitions that support departmental research programs.

The faculty in materials engineering offers experience in all of the basic materials-related disciplines. Each student's program is designed to provide the appropriate balance of academic and research work consistent with that student's background and career objectives.

A brochure describing the department's graduate programs, research interests and faculty members is available upon request.

SELECTED ADVANCED UNDERGRADUATE COURSES

MAT 400 Metallic Materials in Engineering Design. *Preq.: MAT 200 or 201. 3(3-0) F.S.*

MAT 410 Computer Applications for Materials Engineering. *Preqs.: CSC 111; Coreq.: MAT 330. 3(3-0) S.*

MAT 411 Physical Principles in Materials Science I. *Preq.: MAT 321. 3(3-0) F.*

MAT 423 Materials Factors in Design. *Preq.: MAT 450. 3(2-3) S.*

MAT 431 Physical Metallurgy I. *Preqs.: MAT 321, 450. 4(4-0) F.*

MAT 432 Physical Metallurgy II. *Preq.: MAT 431. 3(3-0) S.*

MAT 435 Physical Ceramics I. *Preqs.: MAT 321, MAT 434. 3(3-0) F.*

MAT 436 Physical Ceramics II. *Preq.: MAT 435. 3(3-0) S.*

MAT 450 Mechanical Properties of Materials. *Preq.: MAT 325 and 330; MAE 314. 3(3-0) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

MAT 500 Modern Concepts in Materials Science. *Preq.: Grad. standing. 3(3-0) F.* Fundamentals of structure, structure modification and properties of materials with emphasis on structure-property relationships and the modern theory of solids.

MAT 503 Ceramic Microscopy. *Preq.: MEA 331. 3(2-3) F.* Transmitted and reflected light techniques for the systematic study of ceramic materials and products.

MAT 509 High Vacuum Technology. *Preq.: CH 433 or MAT 301. 3(2-3) F.S.* Properties of low-pressure gases and vapors. Production, maintenance and measurement of high vacuum; design, construction and operation of high vacuum-high temperature facilities. Properties and reactions of materials which are processed, tested and/or utilized in high vacuum environments.

MAT 510 Structure of Crystalline Materials. *Preq.: MAT 411; Coreq.: MAT 500. 3(3-0) F.* The lattice structure of crystals, including group theory applications, reciprocal lattice concept and the study of crystal structure as related to bonding.

MAT 520 Theory and Structure of Materials. *Preq.: MAT 510. 3(3-0) S.* Structure of liquids and crystalline and amorphous solids used in engineering systems. Crystallinity and thermal properties. Ionic crystals in ceramic systems. The metallic state and alloy behavior. Emphasis on the relationship between fundamental materials parameters and engineering properties.

MAT (NE) 525 Nuclear Materials. *3(3-0) F.* (See nuclear engineering.)

MAT 527 Refractories in Service. *Preq.: MAT 411. 3(3-0) S.* A study of the physical and chemical properties of the more important refractories in respect to their environment in industrial and laboratory furnaces.

MAT 529 Properties of High Temperature Materials. *Preqs.: MAT 201 and MAT 301. 3(3-0) S.* Effects of temperature on the physical, mechanical and chemical properties of inorganic materials; relationships between microstructure and high temperature properties; applications of ceramics, metals and composites at elevated temperatures.

MAT 530 Phase Transformations in Materials I. *Coreq.: MAT 500. 3(3-0) F,S.* Kinetic theory of transformations, nucleation theory, homogeneous and heterogeneous nucleation, growth of crystals, epitaxial thin films.

MAT (MAE) 531 Materials Processing by Deformation. *3(3-0) F.* (See mechanical and aerospace engineering.)

MAT (MAE) 532 Fundamentals of Metal Machining Theory. *3(3-0) S.* (See mechanical and aerospace engineering.)

MAT 533, 534 Advanced Ceramic Engineering Design I, II. *Preq.: MAT 417. 3(2-3) F,S.* Advanced studies in analysis and design of ceramic products, processes and systems leading to original solutions of current industrial problems and the development of new concepts of manufacturing.

MAT 540 Glass Technology. *Preq.: MAT 435. 3(3-0) F.* Fundamentals of glass manufacture including compositions, properties and application of the principal types of commercial glasses.

MAT 541, 542 Principles of Corrosion I, II. *Preqs.: MAT 201 and CH 431 or MAT 301. 3(2-3) F,S.* The fundamentals of metallic corrosion and passivity. The electro-chemical nature of corrosive attack, basic forms of corrosion, corrosion rate factors, methods of corrosion protection. Laboratory work included.

MAT 550 Dislocation Theory. *Preq.: MAT 450. 3(3-0) F.* Structure, energetics, stress and strain fields, interactions and motion of dislocations in solids.

MAT 556 Composite Materials. *Preq.: MAT 450. 3(3-0) F.* Basic principles underlying the properties of composite materials as related to properties of the individual constituents and their interactions. Emphasis on the design of composite systems to yield desired combinations of properties.

MAT (NE) 562 Materials Problems in Nuclear Engineering. *Preq.: Advanced undergrad. standing. 3(3-0) F.* Reactor design and operating considerations determined by materials properties. Emphasis on the interrelations among materials, compatibility effects, corrosion effects and radiation effects in fission and fusion reactors.

MAT (NE) 573 Computer Experiments in Materials and Nuclear Engineering. *Preq.: Advanced undergrad. standing. 3(3-0) S.* Monte Carlo and dynamical computer experiments are covered from the standpoint of how to design and use them in materials and nuclear engineering work.

MAT 595 Advanced Materials Experiments. *Preq.: Sr. or grad. standing. 1-3.* Advanced engineering principles applied to a specific experimental project dealing with materials. A seminar period is provided and a written report is required.

FOR GRADUATES ONLY

MAT 601 Ceramic Phase Relationships. *Preq.: Cl. 3(3-0) S.* Heterogeneous equilibrium phase transformations, dissociation, fusion, lattice energy, defect structure, thermodynamic properties of ionic phases and silicate melts.

MAT 603 Advanced Ceramic Reaction Kinetics. *Preq.: MAT 510. 3(3-0) S.* Fundamental study of the kinetics of high temperature ceramic reactions such as diffusion, nucleation, grain growth, recrystallization, phase transformation, vitrification and sintering.

MAT 610 X-ray Diffraction. *Preq.: MAT 510. 3(3-0) F.* The properties and scattering behavior of x-rays by electrons, ions and atoms. Theory and applications of x-ray diffraction techniques such as Laue back reflection, the rotating crystal and powder methods, texture studies, residual stress analysis, radial distribution in amorphous materials and small angle scattering.

MAT 615 Electron Microscopy. *Preqs.: MAT 550, 610. 3(3-0) F.* Theory of imaging and diffraction of electrons. Analysis of structures using electron microscopy.

MAT 621 Theory and Structure of Amorphous Materials. *Preq.: MAT 500. 3(3-0) S.* Bond types and structure of amorphous solids, relations of bond types and structure to flow mechanisms, electrical, optical and thermal properties.

MAT 622 Theory and Structure of Ceramic Materials. *Preq.: MAT 500. 3(3-0) F.* Electrical and optical properties of non-conducting materials, ferro-electric behavior and materials parameters, magnetic properties of non-metallics, semi-conducting materials.

MAT 623 Theory and Structure of Metallic Materials. *Preq.: MAT 500. 3(3-0) F.* The metallic state, its atomic and electronic structure. Electron theory of metals and alloys. Advanced methods of determining electronic structure in metallic materials. Solid solutions and intermediate phases, superconducting and magnetic alloys.

MAT 630 Phase Transformation in Materials II. *Preqs.: MAT 510, 530, 550. 3(3-0) F.* Formal theories of solid-solid transformations, transformation mechanisms, transformation morphologies.

MAT 631, 632 Advanced Physical Ceramics I, II. *Coreqs.: MAT 510, 610 or MAT 530, 630 or CE 511, 512 or PY 503, 552. 3(2-3) F,S.* Lattice structures and lattice energies in crystalline ceramics; relationships with elastic, optical and thermal properties. Effects of constitution and microstructure on lattice-sensitive properties. The defect crystalline state in ceramics; vacancies, color centers; dislocations, boundaries. Crystal growth. Plastic deformation processes, including creep and fatigue; the ductile-brittle transition. Structure-sensitive properties of crystalline, vitreous and composite ceramics; effects of constitution, microstructure and non-stoichiometry.

MAT 633 Advanced Mechanical Properties of Materials. *Preq.: MAT 630. 3(3-0) F.* The theories of yield strength, work hardening, creep, fracture and fatigue of crystalline materials will be developed in terms of dislocation theory.

MAT 661 Diffraction Theory. *Preq.: MAT 610. 3(3-0) F.* The diffraction of light, x-rays, electrons and neutrons by matter is represented in Fourier space, and the known methods of generating the Fourier transform (usually atomic structure) are reviewed. Exploration, by high and low angle scattering techniques, of crystals, paracrystals, liquids, polydispersed aggregates and fibers. Feasibility of direct analysis by convolution integrals.

MAT 691, 692 Advanced Topics in Materials Engineering. *Preq.: Grad. standing. 1-3.* Special studies of advanced topics in materials engineering.

MAT 695 Materials Engineering Seminar. *1(1-0) F,S.* Reports and discussion of special topics in materials engineering and allied fields.

MAT 699 Materials Engineering Research. *Credits Arranged.* Independent investigation of an appropriate research problem. A report on this investigation is required as a graduate thesis.

Mathematics

GRADUATE FACULTY

Professor E. E. Burniston, Head

Associate Professor: J. E. Franke, Graduate Administrator

Professors: J. W. Bishir, S. L. Campbell, R. E. Chandler, J. M. A. Danby, J. C. Dunn, M. J. Evans, R. O. Fulp, R. E. Hartwig, K. Koh, J. R. Kolb, J. Luh, J. A. Marlin, L. B. Martin Jr., R. H. Martin Jr., C. D. Meyer, P. A. Nickel, C. V. Pao, E. L. Peterson, R. J. Plemmons, M. S. Putcha, N. J. Rose, H. Sagan, C. E. Siewert, E. L. Stitzinger, R. A. Struble, H. R. Van der Vaart, O. Wesler, J. B. Wilson; Professors Emeriti: R. C. Bullock, J. M. Clarkson, W. G. Dotson Jr., W. J. Harrington, J. Levine, H. M. Nahikian, H. V. Park, H. E. Speece, L. S. Winton; Associate Professors: L. O. Chung, J. D. Cohen, G. D. Faulkner, J. E. Franke, C. T. Kelley, T. J. Lada, D. M. Latch, L. B. Page, E. W. Sachs, S. Schechter, J. F. Selgrade, R. Silber, J. W. Silverstein, M. F. Singer, W. M. Waters Jr., R. E. White; Associate Professor Emeritus: J. W. Querry; Assistant Professors: H. J. Charlton, M. T. Chu, D. W. Decker, D. E. Garoutte, D. J. Hansen, L. K. Norris, S. O. Paur, R. T. Ramsay, J. Rodriguez, J. L. Sox Jr., D. F. Ullrich

The Department of Mathematics offers programs leading to the degrees of Master of Science and Doctor of Philosophy with a major in either mathematics or applied mathematics.

Applicants for admission should have an undergraduate degree in mathematics or its equivalent. This should include a year of mathematical analysis (or advanced calculus) and a year of modern algebra, including linear algebra. All applicants are advised to take the Graduate Record Examination including the Advanced Test in Mathematics.

A number of teaching assistantships are available. A student carrying a half-time assistantship is allowed to carry a course load of nine semester hours.

The requirements for the Master of Science degree include 36 semester hours of approved credits and a comprehensive examination. A master's project for 3 hours credit is required. Foreign languages are not required for the master's degree.

There is no prescribed minimum number of courses for the degree of Doctor of Philosophy. Normally a student will take approximately 60 semester hours of course credits including certain core courses in algebra, analysis and applied mathematics. Independent reading and participation in seminars constitute an indispensable part of the doctoral program.

All doctoral students are required to have a reading knowledge of two modern foreign languages. Comprehensive examinations are also required. These consist of a written examination designed to test basic knowledge and oral and written examinations on material related to the field of proposed thesis work.

The heart of the doctoral program is the dissertation. It must be original research resulting in a significant contribution in some area of mathematics or its applications and should be worthy of publication in the current literature. The doctoral dissertation must be defended at the final oral examination.

A detailed statement of requirements for graduate degrees is available on request from the graduate administrator.

SELECTED ADVANCED UNDERGRADUATE COURSES

MA 401 Applied Differential Equations II. *Preq.: MA 301. Credit for both MA 401 and MA 501 will not be given. 3(3-0) F,S,Sum.*

MA (PHI) 402 Advanced Logic. *Preq.: PHI 335 or CI. 3(3-0) S.*

MA 403 Introduction to Modern Algebra. *Preq.: One year of calculus. 3(3-0) F,S,Sum.*

MA 403M Introduction to Modern Algebra for Mathematics Majors. *Preq.: One year of calculus (MA 225 is desirable). 3(3-0) F,S.*

MA 405 Introduction to Linear Algebra and Matrices. *Preq.: One year of calculus. 3(3-0) F,S,Sum.*

MA 408 Foundations of Euclidean Geometry. *Preq.: MA 403. 3(3-0) F.*

MA 410 Theory of Numbers. *Preq.: One year of calculus. 3(3-0) S.*

MA 414 Introduction to Differential Geometry. *Preqs.: MA 202 and 405. 3(3-0) S.*

MA (CSC) 416 Introduction to Combinatorics. *Preq.: MA 403 or CSC 322. 3(3-0) F.*

MA 421 Introduction to Probability. *Preq.: One year of calculus. 3(3-0) F,S,Sum.*

MA 425 Mathematical Analysis I. *Preq.: MA 202 (MA 403 desirable). 3(3-0) F,S.*

MA 426 Mathematical Analysis II. *Preqs.: MA 425 and MA 405. 3(3-0) S.*

MA (CSC) 427 Introduction to Numerical Analysis I. *Preqs.: MA 301 and a programming language proficiency. 3(3-0) F.*

MA (CSC) 428 Introduction to Numerical Analysis II. *Preqs.: MA 405 and programming language proficiency. 3(3-0) S.*

MA 430 Mathematical Models in the Physical Sciences. *Preqs.: MA 301 and MA 405. 3(3-0) S.*

MA 432 Mathematical Models in Life Sciences and Social Sciences. *Preqs.: MA 301, MA 405; Coreq.: MA 421 or ST 371. 3(3-0) F.*

MA 433 History of Mathematics. *Preq.: One year of calculus. 3(3-0) F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

MA 501 Advanced Mathematics for Engineers and Scientists I. *Preq.: MA 301 or equivalent. Credit for this course and MA 401 is not allowed. 3(3-0) F,S,Sum.* Survey of mathematical methods for engineers and scientists. Ordinary differential equations and Green's functions; partial differential equations and separation of variables; special functions, Fourier series. Applications to engineering and science are stressed. This course cannot be taken for credit by mathematics majors.

MA 502 Advanced Mathematics for Engineers and Scientists II. *Preq.: MA 301 or equivalent. Any student receiving credit for MA 502 may receive credit for, at most, one of the following: MA 405, MA 512, MA 513. 3(3-0) F,S,Sum.* Determinants and matrices; line and surface integrals, integral theorems; complex integrals and residues; distribution functions of probability. This course cannot be taken for credit by mathematics majors.

MA (IE, OR) 505 Linear Programming. *3(3-0) F,S.* (See industrial engineering.)

MA 507 Analysis for Secondary Teachers. *Preq.: Grad. standing. 3(3-0) F,Sum. Alt. yrs.* A course designed to update and broaden the secondary teacher's capability and point-of-view with respect to topics in analysis. Emphasis is upon the historical development, logical refinement and applications of concepts such as limits, continuity, differentiation and integration. This course may be taken for graduate credit for certificate renewal by secondary school teachers. Credit towards a graduate degree may be allowed only for students in mathematics education.

MA 508 Geometry for Secondary Teachers. *Preq.: Grad. standing. 3(3-0) S,Sum. Alt. yrs.* A course designed to study topics in geometry of concern to secondary teachers in their work and to provide background and enrichment. Various approaches to the study of geometry are investigated, including vector geometry, transformational geometry and axiomatics. This course may be taken for graduate credit and for certificate renewal by secondary school teachers. Credit towards a graduate degree may be allowed only for students in mathematics education.

MA 509 Abstract Algebra for Secondary Teachers. *Preq.: Grad. standing. 3(3-0) F,Sum. Alt. yrs.* A course designed to investigate from an advanced viewpoint topics in algebra from the high school curriculum. Emphasis is upon the theory of equations, polynomial rings, rational functions and elementary number theory. This course may be taken for graduate credit for certificate renewal by secondary school teachers. Credit towards a graduate degree may be allowed only for students in mathematics education.

MA 510 Selected Topics in Mathematics for Secondary Teachers. *Preq.: Grad. standing. 3(3-0) S,Sum. Alt. yrs.* A course designed to cover various topics in mathematics of concern to secondary teachers. Topics will be selected from areas such as mathematics of finance, probability, statistics, linear programming and theory of games, intuitive topology, recreational math, computers and applications of mathematics. This course may be taken for graduate credit for certification renewal by secondary school teachers. Credit towards a graduate degree may be allowed only by students in mathematics education.

MA 511 Advanced Calculus I. *Preq.: MA 301. May not be taken for credit by undergrad. mathematics majors. 3(3-0) F,S,Sum.* Fundamental theorems on continuous functions; convergence theory of sequences, series and integrals; the Riemann integral.

MA 512 Advanced Calculus II. *Preq.: MA 301. 3(3-0) F,S,Sum.* General theorems of partial differentiation; implicit function theorems; vector calculus in 3-space; line and surface integrals; classical integral theorems.

MA 513 Introduction to Complex Variables. *Preq.: MA 202. 3(3-0) F,S,Sum.* Operations with complex numbers, derivatives, analytic functions, integrals, definitions and properties of elementary functions, multivalued functions, power series, residue theory and applications, conformal mapping.

MA 514 Methods of Applied Mathematics. *Preq.: MA 511 or 425. 3(3-0) S.* Introduction to integral equations, the calculus of variations and difference equations.

MA 515 Linear Functional Analysis I. *Preq.: MA 426. 3(3-0) F.* Metric spaces; Lebesgue measure and integration; L^p and l^p spaces; Riesz-Fischer and Riesz representation theorems; normed linear spaces and Hilbert spaces.

MA 516 Linear Functional Analysis II. *Preq.: MA 515. 3(3-0) S.* Basic theorems in Banach spaces, dual spaces, weak topologies; basic theorems in Hilbert spaces and detailed theory of linear operators on Hilbert spaces; spectral theorem for self-adjoint completely continuous linear operators.

MA 517 Introduction to Topology. *Preq.: MA 426. 3(3-0) F.* Sets and functions, metric spaces, topological spaces, compactness, separation, connectedness.

MA 518 Calculus on Manifolds. *Preq.: MA 426. 3(3-0) S.* Calculus of several variables from a modern viewpoint. Differential and integral calculus of several variables, vector functions, integration of manifolds, Stokes' and Green's theorems, vector analysis.

MA 520 Linear Algebra. *Preq.: MA 405. 3(3-0) F.* Vector spaces, linear mappings and matrices, determinants, inner product spaces, bilinear and quadratic forms, canonical forms, spectral theorem.

MA 521 Fundamentals of Modern Algebra. *Preqs.: MA 403 and 520. 3(3-0) S.* Groups, normal subgroups, quotient groups, Cayley's theorem, Sylow's theorem. Rings, ideals and quotient rings, polynomial rings. Fields, extension fields, elements of Galois theory.

MA 523 Topics in Applied Mathematics. *Coreqs.: MA 515, 520. 3(3-0) F.* Formulation of scientific problems in mathematical terms, interpretation and evaluation of the mathematical analysis of the resulting models. The course will discuss problems in behavioral and biological sciences as well as problems in mechanics of discrete and continuous systems. Some discussion of optimization and the calculus of variations.

MA 524 Mathematical Methods in the Physical Sciences I. *Preqs.: MA 405, 511 and either MA 401 or 501. 3(3-0) F.* Green's functions and two-point boundary value problems; elementary theory of distributions; generalized Green's functions. Finite and infinite dimensional inner product spaces; Hilbert spaces; completely continuous operators; integral equations; the Fredholm alternative; eigenfunction expansions; applications to potential theory. Nonsingular and singular Sturm-Liouville problems; Weil's theorem.

MA 525 Mathematical Methods in the Physical Sciences II. *Preq.: MA 524. 3(3-0) S.* Distribution theory in n -space; Fourier transforms; partial differential equations, generalized solutions, fundamental solutions, Cauchy problem, wave and heat equations, well-set problems. Laplace's equation, the Dirichlet and Neumann problems, integral equations of potential theory, Green's functions, eigenfunction expansions.

MA (CSE) 529, 530 Numerical Analysis I, II. *Preqs.: (529) MA 405, MA 511 or equivalents, knowledge of a high level computing language; (530) MA 529. 3(3-0) F,S.* A prac-

tical survey of numerical analysis for graduate students in the engineering, physical and mathematical sciences. Topics chosen from: iterative methods for nonlinear equations, approximation theory, numerical solution of ordinary and partial differential equations, numerical linear algebra. Computing assignments illustrate algorithm behavior and applicability.

MA (E, OR) 531 Dynamical Systems and Multivariable Control. *3(3-0) F.* (See operations research.)

MA 532 Theory of Ordinary Differential Equations. *Preqs.: MA 301, 405, advanced calculus. 3(3-0) S.* Existence and uniqueness theorems, systems of linear equations, fundamental matrices, matrix exponential, series solutions, regular singular point; plane autonomous systems, stability theory.

MA 534 Introduction to Partial Differential Equations. *Preqs.: MA 425 or MA 511, MA 301. 3(3-0) F.* Theory of characteristics and classification of second order equations, existence, uniqueness and representation of solutions for the wave equation, Dirichlet and Neumann boundary-value problems for the Laplace equation, potential theory in two and higher dimensional domains, mean-value theorem and the maximum principle, Green's identities, initial boundary-value problems of heat equation and wave equation. Maximum principle of parabolic equation, method of eigenfunction expansions, Fourier series and Fourier transforms.

MA (CSE) 536 Theory of Sequential Machines. *Preq.: CSC 412 or grad. standing. 3(3-0) F.* Sequential machine identification experiments. Finite-Memory machines. Special classes of machines. Decomposition of sequential machines. Linear sequential machines. Sequential relations of finite-state machines.

MA (CSE) 537 Theory of Computability. *Preq.: CSC 412 or grad. standing. 3(3-0) S.* The concept of effective computability. Turing Machines. Primitive recursive functions. The μ operator. μ -recursive functions. Godel numbering. Equivalence of Turing Machines and μ -recursion. Undecidable predicates. Universal Turing Machines. Other formulations of the concept of effective computability.

MA (ST) 541 Theory of Probability I. *Preq.: MA 425 or 511. 3(3-0) F, Sum.* Axioms, combinatorial analysis, conditional probability, independence, random variables, expectation, special discrete and continuous distributions, probability and moment generating functions, central limit theorem, laws of large numbers, branching processes, recurrent events, random walk.

MA (ST) 542 Introduction to Stochastic Processes. *3(3-0) S.* (See statistics.)

MA 545 Set Theory and Foundations of Mathematics. *Preq.: MA 403. 3(3-0) S.* Logic and the axiomatic approach, the Zermelo-Fraenkel axioms and other systems, algebra of sets and order relations, equivalents of the Axiom of Choice, one-to-one correspondences, cardinal and ordinal numbers, the Continuum Hypothesis.

MA (PY) 555 Mathematical Introduction to Celestial Mechanics. *Preq.: MA 301. 3(3-0) F.* Central orbits, N-body problem, 3-body problem, Hamilton-Jacobi theory, perturbation theory, applications to motion of celestial bodies.

MA (PY) 556 Orbital Mechanics. *Preqs.: MA 301, 405, knowledge of elementary mechanics and computer programming. 3(3-0) S.* Keplerian motion, iterative solutions, numerical integration, differential corrections and space navigation, elements of probability, least squares, sequential estimation, Kalman filter.

MA (BMA, ST) 571 Biomathematics I. *3(3-0) F.* (See biomathematics.)

MA (BMA, ST) 572 Biomathematics II. 3(3-0) S. (See biomathematics.)

MA 581 Special Topics. *Preq.: Consent of department.* 1-6 F,S.

MA (CSC) 582 Numerical Linear Algebra. *Preqs.: MA 405 or equivalent and a knowledge of computer programming.* 3(3-0) F. A mathematical and numerical investigation of direct, iterative and semi-iterative methods for the solution of linear systems. Methods for the calculation of eigenvalues and eigenvectors of matrices.

MA (CSC) 583 Numerical Solution of Ordinary Differential Equations. *Preq.: Knowledge to the level of CSC 427.* 3(3-0) S. Numerical methods for initial value problems including predictor-corrector, Runge-Kutta, hybrid and extrapolation methods; stiff systems; shooting methods for two-point boundary value problems; weak, absolute and relative stability results.

MA (CSC) 584 Numerical Solution of Partial Differential Equations—Finite Difference Methods. *Preqs.: MA 501; knowledge of a high level programming language.* 3(3-0) F. A survey of finite difference methods for partial differential equations including elliptic, parabolic and hyperbolic PDE's. Both linear and nonlinear problems are considered. Theoretical foundations are described; however, emphasis is placed on algorithm design and implementation.

MA (CSC, OR) 585 Graph Theory. 3(3-0) F. (See computer science.)

MA (IE, OR) 586 Network Flows. 3(2-2) S. (See industrial engineering.)

MA (CSC) 587 Numerical Solution of Partial Differential Equations—Finite Element Method. *Preqs.: MA 501; knowledge of a high level programming language.* 3(3-0) S. An introduction to the finite element method. Applications to both linear and nonlinear elliptic and parabolic partial differential equations. Theoretical foundations are described; however, emphasis is placed on algorithm design and implementation.

FOR GRADUATES ONLY

MA 600 Advanced Differential Equations I. *Preqs.: MA 513, 518, 520.* 3(3-0) F. *Alt. yrs.* Analytical theory of ordinary differential equations, stability theory, perturbations, asymptotic behavior, nonlinear oscillations.

MA 601 Advanced Differential Equations II. *Preq.: MA 600.* 3(3-0) S. *Alt. yrs.* Qualitative theory of ordinary differential equations, general properties of dynamical systems, limit sets, integral invariants, global theory.

MA 602 Partial Differential Equations I. *Preqs.: MA 426, 520, 532 or 600.* 3(3-0) F. *Alt. yrs.* First order equations, initial value problems; theory of characteristics; existence and uniqueness theorems; hyperbolic equations.

MA 603 Partial Differential Equations II. *Preq.: MA 602.* 3(3-0) S. *Alt. yrs.* Elliptic and parabolic equations; approximation methods; generalized solutions.

MA 604 Topology. *Preqs.: MA 515, 520.* 3(3-0) S. Topological spaces: separation axioms, compactness, connectedness, local topological properties; continuous mappings and convergence; product and quotient spaces; compactification; homotopy equivalence of mappings, fundamental groups, covering spaces, universal coverings, deck transformations.

MA 605 Homology and Manifolds. *Preq.: MA 604.* 3(3-0) F. Homology; either simplicial or singular theory, excision theorem, homotopy theorem, Mayer-Vietoris theorem and com-

putation of groups, topology and geometry of differentiable manifolds, vector fields, Lie derivations and differential equations; smooth partitions of unity, integration, differential forms and Stokes' theorem; the DeRham cohomology and the DeRham theorem.

MA (ST, OR) 606 Nonlinear Programming. 3(3-0) S. (See statistics.)

MA (NE) 607 Exact and Approximate Solutions in Particle Transport Theory. 3(3-0) S. (See nuclear engineering.)

MA 611 Analytic Function Theory I. *Preq.: MA 426.* 3(3-0) F. A rigorous introduction to the theory of functions of a complex variable. The complex plane, functions, Mobius transformations, the exponential and logarithmic functions, trigonometric functions, infinite series, integration in the complex plane, Cauchy's theorem and its consequences.

MA 612 Analytic Function Theory II. *Preq.: MA 611.* 3(3-0) S. A continuation of MA 611. Taylor and Laurent series. The residue theorem, the argument principle, harmonic functions and the Dirichlet problem, analytic continuation and the monodromy theorem, entire and meromorphic functions, the Weierstrass product representation and the Mittag-Leffler partial fraction representation, special functions, conformal mapping and the Picard theorem.

MA 613 Techniques of Complex Analysis. *Preq.: MA 513 or 611.* 3(3-0) S. A course dealing with the applications of complex analysis to mathematical problems in physical science in the setting of the potential equation and other partial differential equations: contour integrals, special functions of mathematical physics from the line integral point of view, solution of problems in potential theory, asymptotic methods including WKB and Wiener-Hopf techniques.

MA (OR) 614 Integer Programming. 3(3-0) S. *Alt. yrs.* (See operations research.)

MA 615 Theory of Functions of a Real Variable. *Preq.: MA 516.* 3(3-0) S. Real functions, semicontinuity, upper and lower limits, sequences; Lebesgue measure and integration, absolute continuity and differentiation.

MA (ST) 617, 618 Measure Theory and Advanced Probability. 3(3-0) F,S. (See statistics.)

MA (ST) 619 Topics in Advanced Probability. 3(3-0) F. (See statistics.)

MA 620 Modern Algebra I. *Preq.: MA 521.* 3(3-0) F. *Alt. yrs.* A study of groups, rings and modules. Elements of homology. Polynomials, Noetherian rings, Algebraic extensions, Galois theory.

MA 621 Modern Algebra II. *Preq.: MA 620.* 3(3-0) S. *Alt. yrs.* A study of linear maps, bilinear forms, representations, multilinear products, semisimplicity and the representation of finite groups.

MA 622 Linear Transformations and Matrix Theory. *Preq.: MA 405.* 3(3-0) F. Vector spaces, linear transformation and matrices, minimal polynomials, elementary divisors, canonical forms, quadratic forms, functions of matrices.

MA 623 Theory of Matrices and Applications. *Preq.: MA 520 or 622.* 3(3-0) S. Generalized inverses, matrix equation, variational methods for eigenvalues, matrix norms, perturbation of linear systems, computational methods, applications to differential equations, Markov chains.

MA 626 Algebraic Topology. *Preq.: MA 605.* 3(3-0) S. *Alt. yrs.* Simplicial and singular homology and cohomology, the Eilenberg-Steenrod axioms, duality, cohomology operations; higher homotopy groups, Hurewicz homomorphisms.

MA 628 General Topology. *Preq.: MA 604. 3(3-0) F. Alt. yrs.* Comparisons of topologies on function spaces; Ascoli theorems; Stone-Weierstrass theorems; uniform spaces and completions; paracompactness and partitions of unity; an introduction to a special topic such as topological vector spaces or topological groups.

MA (OR) 629 Vector Space Methods in System Optimization. *3(3-0) F.* (See operations research.)

MA 632 Operational Mathematics I. *Preq.: MA 513 or 611. 3(3-0) F.* Laplace transforms with theory and application to ordinary and partial differential equations arising from problems in engineering and physics.

MA 633 Operational Mathematics II. *Preq.: MA 632. 3(3-0) S.* Extended development of the Laplace and Fourier transforms and their application to the solution of ordinary and partial differential equations, integral equations and difference equations; Z-transforms, other infinite and finite transforms and their applications.

MA 634 Theory of Distributions. *Preq.: MA 632 or CI. 3(3-0) F. Alt. yrs.* Basic definitions and properties of testing functions and distributions in one or more variables, convergence and calculus of distributions, test functions of rapid descent and distributions of slow growth, convolution, Fourier transforms, applications in the area of differential and difference equations, etc.

MA 637 Differentiable Manifolds. *Preqs.: MA 405, 521; Coreq.: MA 604. 3(3-0) F. Alt. yrs.* An introduction to the topology and geometry of differentiable manifolds, multilinear algebra, exterior differential forms, differentiable manifolds, theory of connexions, Riemannian manifolds.

MA 641 Calculus of Variations and Theory of Optimal Control I. *Preqs.: MA 512 or 426, MA 532. 3(3-0) F. Alt. yrs.* Normed linear function spaces and Frechet differential, theory of the first variation, theory of fields and Weierstrass' excess function, Hamilton-Jacobi theory and dynamic programming, terminal control problems and the maximum principle.

MA 642 Calculus of Variations and Theory of Optimal Control II. *Preq.: MA 641. 3(3-0) S. Alt. yrs.* The homogeneous problem, the general control problem of Mayer, isoperimetric problems, theory of the second variation, existence of extrema, direct methods of the calculus of variations.

MA 647 Functional Analysis I. *Preq.: MA 516. 3(3-0) F. Alt. yrs.* Banach spaces; linear functionals; linear operators, uniform boundedness, open mapping and closed graph theorems; dual spaces; weak topologies.

MA 648 Functional Analysis II. *Preq.: MA 647. 3(3-0) S. Alt. yrs.* Advanced topics in functional analysis such as linear topological spaces; Banach algebra, spectral theory and abstract measure theory and integration.

MA 661 Differential Geometry and Tensor Analysis I. *Preq.: MA 426 or 512. 3(3-0) F. Alt. yrs.* Concepts of classical and modern differential geometry presented from the point of view of tensor analysis and differential forms. Topics to include: theory of curves, tensor analysis and differential forms, intrinsic geometry of surfaces, Riemannian geometry.

MA 662 Differential Geometry and Tensor Analysis II. *Preq.: MA 661. 3(3-0) S. Alt. yrs.* Continuation of MA 661.

MA (CSE) 679, 680 Advanced Numerical Analysis I, II. *Preqs.: (679) MA 515 and one of MA (CSE) 529, MA (CSC) 582, 583, 584, 587; (680) MA 679. 3(3-0) F, S.* Review of real analysis

including multilinear algebra and topological vector spaces. Numerical solution of linear and nonlinear systems, eigenvalues and eigenvectors, approximation theory, quadrature, ordinary differential equations, optimization.

MA 681 Special Topics in Real Analysis. 1-6.

MA 682 Special Topics in Complex Analysis. 1-6.

MA 683 Special Topics in Algebra. 1-6.

MA 684 Special Topics in Combinatorial Analysis. 1-6.

MA 685 Special Topics in Numerical Analysis. 1-6.

MA 686 Special Topics in Topology. 1-6.

MA 687 Special Topics in Geometry. 1-6.

MA 688 Special Topics in Differential Equations. 1-6.

MA 689 Special Topics in Applied Mathematics. 1-6.

The subject matter in the special topics courses varies from year to year. The topics and instructors are announced well in advance by the department.

MA (IE, OR) 692 Special Topics in Mathematical Programming. 3(3-0) F,S,Sum. (See industrial engineering.)

MA 699 Research. Credits Arranged. Individual research in mathematics.

Mathematics and Science Education

For a listing of graduate faculty and departmental information, see mathematics and science education under education.

Mechanical and Aerospace Engineering

GRADUATE FACULTY

Professor J. A. Bailey, Head

Professor J. C. Mulligan, Graduate Administrator

Professors: E. M. Afify, F. R. DeJarnette, T. A. Dow, J. A. Edwards, B. H. Garcia Jr., W. C. Griffith, F. J. Hale, F. D. Hart, H. A. Hassan, T. H. Hodgson, M. N. Ozisik, J. N. Perkins, L. H. Royster, F. O. Smetana, F. Y. Sorrell, J. K. Whitfield, C. F. Zorowski; *Visiting Professors:* M. M. Fikry, S. A. Jurovics; *Adjunct Professors:* R. L. Bradow, C. T. Crowe, R. E. Fulton, D. E. Klett, E. R. McClure, E. A. Saibel; *Professors Emeriti:* R. A. Burton, M. H. Clayton, J. S. Doolittle, J. Woodburn; *Associate Professors:* M. A. Boles, M. D. Bryant, A. C. Eberhardt, H. M. Eckerlin, R. R. Johnson, R. F. Keltie, C. Kleinstreuer, J. W. Leach, C. J. Maday, D. S. McRae, R. T. Nagle, J. S. Strenkowski, S. Torquato; *Adjunct Associate*

Professors: R. W. Barnwell, J. F. Campbell, D. P. Colvin, P. B. Corson, R. M. Hall, D. M. Rao, R. E. Singleton, R. A. Whisnant; *Assistant Professors:* J. W. David, L. M. Silverberg; *Adjunct Assistant Professors:* J. A. Daggerhart, A. L. Patra; *Visiting Lecturer:* J. S. Stewart

The Department of Mechanical and Aerospace Engineering offers graduate study leading to the Master of Mechanical Engineering, Master of Science and Doctor of Philosophy degrees. Entrance to the degree programs is based upon a pertinent, accredited baccalaureate degree.

Graduate study and research are available in the following areas:

(1) thermal sciences including classical and statistical thermodynamics, energy conservation and conversion, solar energy, alternative energy sources, heat and mass transfer; energy systems;

(2) sound and vibration technology including acoustic radiation, industrial and community noise control, transportation noise and hearing conservation, acoustic signal processing and computer vibration analysis;

(3) gas dynamics including subsonic, transonic, supersonic and hypersonic aerodynamics, lasers, plasmagasdynamics and combustion;

(4) computational fluid dynamics for inviscid flows, boundary layers and parabolized and complete Navier-Stokes equations for external and internal flows, grid generation;

(5) aerospace sciences including aeroelasticity, stability and control and aerospace propulsion; aerospace structures;

(6) mechanical sciences including machine vibrations, mechanical transients, materials processing, photoelasticity and experimental stress analysis, finite element analysis and transportation systems and vehicle safety; automatic control of active structures; design optimization;

(7) mechanical design, precision engineering and tribology;

(8) computer-aided design with dedicated graphics work stations, advanced interactive software and a dedicated VAX 11/785 computer.

Extensive laboratory facilities include subsonic and supersonic wind tunnels; extensive sound and vibration laboratories including anechoic chambers, a large reverberation room, a machinery noise laboratory with field test and analysis instrumentation, a signal processing laboratory, a computer graphics and vibration analysis laboratory using a Nicolet 6602 structural analysis system and a Tektronix 4114 terminal for finite-element analysis, a materials processing laboratory; an experimental stress analysis and photoelasticity laboratory; an aeroelasticity laboratory; automotive performance and emission control facility; a solar energy house and laboratory; a heat transfer laboratory; a precision engineering laboratory; and an applied energy research laboratory.

Computational facilities include VAX 11/785 and IBM 3081 computers, micro and array processors, minicomputers and terminals connected to the computational facilities at NASA Langley Research Center.

The objective of the department is to provide graduate education both in rigorous experimental and theoretical research training and practitioner-oriented engineering design.

SELECTED ADVANCED UNDERGRADUATE COURSES

- MAE 403 Air Conditioning.** *Preq.: MAE 302. 3(3-0) F.*
- MAE 404 Refrigeration.** *Preq.: MAE 302. 3(3-0) S.*
- MAE 405 Mechanical Engineering Laboratory III.** *Preq.: MAE 306. 1(0-3) F,S.*
- MAE 406 Energy Conservation in Industry.** *Preqs.: MAE 301 or 307; jr. or sr. status in engineering. 3(2-3) F.*
- MAE 407 Steam and Gas Turbines.** *Preqs.: MAE 302, MAE 308, or MAE 355. 3(3-0) S.*
- MAE 408 Internal Combustion Engine Fundamentals.** *Preq.: MAE 302. 3(3-0) F.*
- MAE 409 Particulate Control in Industrial Atmospheric Pollution.** *Preq.: MAE 301 or equivalent. 3(3-0) F.*
- MAE 410 Convective Heat Transfer and Fluid Flow.** *Preqs.: MAE 301, MAE 308. 3(3-0) F.*
- MAE 411 Machine Component Design.** *Preqs.: MAE 315, 316. 3(3-0) F.*
- MAE 412 Energy Systems.** *Preqs.: MAE 302, MAE 410. 3(3-0) S.*
- MAE 415 Mechanical Engineering Analysis.** *Preqs.: MAE 302, 315, 316, EE 331. 3(3-0) F.*
- MAE 416 Mechanical Engineering Design.** *Preqs.: MAE 302, 315, 316, EE 331. 4(3-2) S.*
- MAE 431 Thermodynamics of Compressible Fluid Flow.** *Preqs.: MAE 301, MA 301, MAE 308. 3(3-0) S.*
- MAE 435 Principles of Automatic Control.** *Preq.: MA 301. 3(3-0) F,S.*
- MAE 442 Automotive Engineering.** *Preq.: Sr. in Engineering. 3(3-0) S.*
- MAE 452 Aerodynamics of V/STOL Vehicles.** *Preq.: MAE 355. 3(3-0) F.*
- MAE 455 Boundary Layer Theory.** *Preq.: MAE 355. 3(3-0) F.*
- MAE 456 Computational Methods in Aerodynamics.** *Preq.: CSC 302 and MAE 455. 3(3-0) S. Alt. yrs.*
- MAE 462 Flight Vehicle Stability and Control.** *Preqs.: MAE 261, 435. 3(3-0) F.*
- MAE 465 Propulsion II.** *Preq.: MAE 365. 4(3-3) F.*
- MAE 466 Propulsion II Laboratory.** *Preqs.: MAE 365; MAE 357; Coreq.: MAE 465. 1(0-3) F.*
- MAE 472 Aerospace Vehicle Structures II.** *Preq.: MAE 371. 4(3-3) S.*
- MAE 473 Aerospace Vehicle Structure II Laboratory.** *Preq.: MAE 371; Coreq.: MAE 472. 1(0-3) S.*
- MAE 478 Aerospace Vehicle Design I.** *Preqs.: MAE 356, 472; Coreqs.: MAE 462, 465. 2(2-0). F.*

MAE 479 Aerospace Vehicle Design II. *Preq.: MAE 478. 3(1-6) S.*

MAE 495 Special Topics in Mechanical and Aerospace Engineering. *1-3 F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

MAE 501 Advanced Engineering Thermodynamics. *Preqs.: MAE 302; MA 401 or MA 511. 3(3-0) F.* Thermodynamics of a general reactive system; conservation of energy and the principles of increase of entropy; the fundamental relation of thermodynamics; Legendre transformations; equilibrium and stability criteria in different representation; general relations; chemical thermodynamics; multi-reaction system; ionization; irreversible thermodynamics; the Onsager relation; applications to thermoelectric, thermomagnetic and diffusional processes.

MAE 502 Advanced Energy Systems. *Preq.: MAE 412. 3(3-0) S.* An engineering examination of energy sources, both conventional and proposed. Review of existing energy conversion systems and a critical examination of advanced systems, such as magnetohydrodynamics, fuel cells, solar, geothermal, wind, tides, thermal gradients in oceans and the hydrogen economy.

MAE 503 Advanced Power Plants. *Preq.: MAE 412. 3(3-0) F.* A critical analysis of the energy balance of thermal power plants, thermodynamics and economic evaluation of alternate schemes of development; study of recent development in the production of power.

MAE 504 Fluid Dynamics of Combustion I. *Preqs.: MAE 301, MAE 355 or MAE 308. 3(3-0) F.* Gas-phase thermochemistry including chemical equilibrium and introductory chemical kinetics. Homogeneous reaction phenomena. Subsonic and supersonic combustion waves in premixed reactants (deflagration and detonation). Effects of turbulence. Introduction to diffusion flame theory.

MAE 505 Heat Transfer Theory and Applications. *Preq.: MAE 410 or equivalent. 3(3-0) F.* Development of basic equations for steady and transient heat and mass transfer processes. Emphasis is placed on the application of the basic equations to engineering problems in the areas of conduction, convection, mass transfer and thermal radiation.

MAE 506 Advanced Automotive Energy Systems. *Preq.: MAE 408. 3(3-0) S.* A critical study of the various cycles and energy systems for automotive transportation is carried out. The feasibility of automotive Rankine cycle power plants, Sterling engines, gas turbines and hydrogen-air fueled engines are discussed. Means of improving the efficiency and exhaust emissions of internal combustion engines and the use of alternative fuel sources are considered.

MAE 510 Effects of Noise and Vibration on Man. *Preqs.: Sr. standing in Engineering, MA 301. 3(3-0) F. Alt. yrs.* Study of the effects of noise and vibration on man. Topics covered include acoustic and vibration fundamentals, auditory and non-auditory response to noise, subjective response to noise, environment noise, body physical characteristics, effects of vibration and shock exposure.

MAE 513 Vibration of Mechanical and Structural Components. *Preq.: MAE 315 or 472. 3(3-0) F.* Modeling of mechanical and structural systems for vibration analysis and presentation of exact and approximate solution techniques. Techniques of vibration control are presented and experience on the digital computer is provided.

MAE 514 Industrial Noise Control. *Preq.: MAE 315. 3(2-3) S.* Provides definition of the industrial noise problem, development of analytical problem solving skills, introduction to instrumentation, involvement in design project, laboratory demonstrations.

MAE 517 Instrumentation in Sound and Vibration Engineering. *Preq.: ECE 331; Coreq.: MAE 513. 3(3-0) S.* This course is devoted to a presentation of measurement techniques and the theory and operation of transducers and amplifiers. An introduction to signal analysis techniques such as power spectral density and correlation is also provided.

MAE 518 Acoustic Radiation I. *Preqs.: MA 301 and MAE 308 or MAE 356. 3(3-0) F.* An introduction to the principles of acoustic radiation from vibrating bodies and their related fields. The radiation of simple sources, the propagation of sound waves in confined spaces and transmission through different media are considered.

MAE 519 Theory of Noise in Transportation Systems. *Preq.: MAE 550. 3(3-0) S.* A study of the basic noise generating mechanisms encountered in transportation systems. Coverage includes jet noise, propeller noise, helicopter noise, fan and compressor noise, aircraft induced community noise, surface vehicle noise models and efforts to control noise in transportation systems.

MAE 525 Advanced Flight Vehicle Stability and Control. *Preq.: MAE 462. 3(3-0) F.* Preliminary analysis and design of flight control systems to include autopilots and stability augmentation systems. Study of effects of inertial cross-coupling and nonrigid bodies on vehicle dynamics.

MAE 526 Inertial Navigation Analysis and Design. *Preq.: MAE 435 or 462. 3(3-0) S.* Performance analysis and engineering design of inertial navigation components, subsystems and systems. Development of transfer functions and application of linear system techniques to determine stability, transient response and errors of gyroscopes, accelerometers, stable platforms and inertial alignment systems. Error analysis and its significance. Preliminary analysis and design of typical inertial navigation systems for aircraft and marine vehicles.

MAE (MAT) 531 Materials Processing by Deformation. *Preq.: Six hours of solid mechanics and/or materials. 3(3-0) F.* The course involves a presentation of the mechanical and metallurgical fundamentals of materials processing by deformation. Topics to be discussed include: principles of metal working, friction, forging, rolling, extrusion, drawing, high energy rate forming, chipless forming techniques, manufacturing system concept in production.

MAE (MAT) 532 Fundamentals of Metal Machining Theory. *Preq.: Six hours of solid mechanics and/or materials. 3(3-0) S.* The course involves a presentation of the mechanical and metallurgical fundamentals of metal machining. Topics to be discussed include: mechanics of machining, temperatures generated, tool life and tool wear, lubrication, grinding process, electrical machining processes, surface integrity, economics, nomenclature of cutting tools.

MAE 533 Finite Element Analysis of Mechanical and Aeronautical Systems I. *Preq.: MAE 472; Coreq.: MAE 415. 3(3-0) F.* Concepts and applications of the finite element method for stress and deformation analysis. Explanation and application of a general purpose finite element program for stress and deformation analysis of simple structures and load-carrying components.

MAE 534 Finite Element Analysis of Mechanical and Aeronautical Systems II. *Preq.: MAE 533. 3(3-0) S.* This course extends the finite element study, initiated in MAE 533, for stress analysis to other fields of interest in mechanical and aerospace engineering. Topics considered include vibration and frequency analysis, heat transfer and potential flow. Two topics of advanced stress analysis, thin shells and the bending of plates, are also included.

MAE 535 Experimental Stress Analysis. *Preq.: MAE 316 or 371, 3(2-3) F.* Theoretical and experimental techniques of strain and stress analysis with emphasis on electrical strain gages and instrumentation, brittle coatings, grid methods and an introduction to photoelasticity. Laboratory includes an investigation and complete report of a problem chosen by the student under the guidance of the instructor.

MAE 536 Photoelasticity. *Preq.: MAE 316 or 371, 3(2-3) S. Alt. yrs.* Theory and experimental techniques of two- and three-dimensional photoelasticity including photoelastic coatings, photoplasticity and an application of photoelastic methods to the determination of stress-strain distributions in loaded members. Laboratory includes an investigation and complete report of a problem chosen by the student under the guidance of the instructor.

MAE 540 Advanced Air Conditioning Design. *Preqs.: MAE 403, 404, 3(3-0) S.* The design of heating and air-conditioning systems; the preparation of specifications and performance tests on heating and air-conditioning equipment.

MAE 541 Advanced Machine Design I. *Preq.: MAE 416, 3(3-0) F.* An advanced integrated treatment of stress analysis and materials engineering devoted to current rational methods of analysis and design applicable to mechanical components. Primary attention placed on the determination and prediction of strength, life and deformation characteristics of machine components as dictated by performance requirements.

MAE (OR) 545 Variational Methods in Optimization Techniques I. *3(3-0) F,S. Alt. yrs.* (See operations research.)

MAE 550 Foundations of Fluid Dynamics. *Preqs.: MAE 301, MAE 355 or MAE 308, 3(3-0) F.* Review of basic thermodynamics pertinent to gas dynamics. Detailed development of the general equations governing fluid motion in both differential and integral forms. Simplification of the equations to those for specialized flow regimes. Similarity parameters. Applications to simple problems in various flow regimes.

MAE 551 Airfoil Theory. *Preq.: MAE 355, 3(3-0) S.* Development of fundamental aerodynamic theory. Emphasis upon mathematical analysis and derivation of equations of motion, airfoil theory and comparison with experimental results. Introduction to supersonic flow theory.

MAE 552 Transonic Aerodynamics. *Preq.: MAE 356, 3(3-0) S.* A detailed study of the latest theoretical and experimental findings in transonic aerodynamics, including two-dimensional and axisymmetric flows.

MAE 553 Compressible Fluids. *Preq.: MAE 356 or MAE 431 or MAE 550, 3(3-0) F. Alt. yrs.* Equations of motion in supersonic flow, Prandtl-Meyer turns, method of characteristics, hodograph plane, supersonic wind tunnels, supersonic airfoil theory and boundary layer shock interaction.

MAE 554 Hypersonic Aerodynamics. *Preq.: MAE 356, 3(3-0) F.* A detailed study of the latest theoretical and experimental findings in hypersonic aerodynamics.

MAE 555 Aerodynamic Heating. *Preq.: MAE 356, 3(3-0) F.* A detailed study of the latest theoretical and experimental findings of the compressible laminar and turbulent boundary layers with special attention to the aerodynamic heating problem. Application of theory in the analysis and design of aerospace hardware.

MAE 556 Mechanics of Ideal Fluids. *Preq.: MAE 355 or MAE 308, 3(3-0) S.* Fundamental principles of fluid dynamics. Mathematical methods of analysis are emphasized. Potential flow theory development with introduction to the effects of viscosity and compressibility. Two-dimensional and three-dimensional phenomena are considered.

MAE 557 Dynamics of Internal Fluid Flow. *Preq.: MAE 356 or MAE 308. 3(3-0) F.* A general development of the governing equations of fluid motion with subsequent restriction to incompressible flow. Exact and approximate solutions of the Navier-Stokes equations for internal laminar flow and elementary boundary layer theory. Applications include: hydrodynamic lubrication, converging-diverging channel flows, entrance flows and turbulent internal flow.

MAE 558 Plasmagasdynamics I. *Preqs.: MAE 356, PY 414. 3(3-0) F.* Study of basic laws governing plasma motion for dense and rarefied plasmas, hydromagnetic shocks, plasma waves and instabilities, simple engineering applications.

MAE 559 Molecular Gas Dynamics I. *Preq.: MAE 550. 3(3-0) F.* Statistical mechanics as applied to the derivation of the equations of gas dynamics from the microscopic viewpoint. Collision processes, treatments of viscosity, heat conduction and electrical conductivity.

MAE (MEA) 563 Geophysical Fluid Mechanics. *3(3-0) F. Alt. yrs. (See marine, earth and atmospheric sciences.)*

MAE (ECE) 565 Gas Lasers. *Preqs.: MAE 356 or equivalent, PY 407. 3(3-0) F.* Study of the principles, design and potential application of ion, molecular, chemical and atomic gas lasers.

MAE 570 Theory of Particulate Collection in Air Pollution Control. *Preq.: MAE 409 or grad. standing. 3(3-0) S.* Particulate matter is classified and its properties are described. The motion of particles as applied to particulate collection is carefully analyzed. The elements of aerodynamic capture of particles are developed and applications in filtration and liquid scrubbing are considered. Fundamentals of acoustical, electrostatic and thermal precipitation are introduced. Sampling techniques and instrumentation are also considered.

MAE 586 Project Work in Mechanical Engineering. *1-6 F,S.* Individual or small group investigation of a problem stemming from a mutual student-faculty interest. Emphasis is placed on providing a situation for exploiting student curiosity.

MAE 589 Special Topics in Mechanical Engineering. *Preq.: Advanced undergrad. or grad. standing. 3(3-0) F,S.* Faculty and student discussions of special topics in mechanical engineering.

FOR GRADUATES ONLY

MAE 601 Statistical Thermodynamics. *Preq.: MAE 501. 3(3-0) S.* Fundamental principles of kinetic theory, quantum mechanics, statistical mechanics and irreversible phenomena with particular reference to thermodynamics systems and processes. The conclusions of classical thermodynamics are analyzed and established from the microscopic viewpoint.

MAE 603 Advanced Direct Energy Conversion. *Preq.: MAE 501. 3(3-0) F.* An engineering study of the modern developments in the field of conversion of heat to power in order to meet new technology demands. Thermoelectric, thermomagnetic, thermionic, photovoltaic and magneto-hydrodynamic effects and their utilization for energy conversion purposes, static and dynamic response, limitations imposed by the first and second laws of thermodynamics. Energy and entropy balances, irreversible sources, inherent losses, cascading, design procedures, experimental studies to determine the response and efficiency of various systems.

MAE 604 Fluid Dynamics of Combustion II. *Preq.: MAE 504. 3(3-0) S.* Advanced theory of detonation and deflagration. Ignition criteria. Direct initiation of detonation including blast-wave theory. Transition from deflagration to detonation. Combustion wave structure and stability. Liquid droplet and solid particle combustion.

MAE 608 Advanced Conductive Heat Transfer. *Preq.: MAE 505. 3(3-0) S.* A generalized treatment of the solution of transient and steady heat conduction in finite and infinite regions. Approximate and exact methods of solution of problems involving phase change, variable thermal properties and non-linear boundary conditions. Heat conduction in composite media and in anisotropic solids.

MAE 609 Advanced Convective Heat Transfer. *Preq.: MAE 557. 3(3-0) S.* Advanced topics in steady and transient, natural and forced convective heat transfer for laminar and turbulent flow through conduits and over surfaces. Mass transfer in laminar and turbulent flow is also covered. Topics on compressible flow with heat and mass transfer are included.

MAE 610 Advanced Radiative Heat Transfer. *Preq.: MAE 505. 3(3-0) F.* A comprehensive and unified treatment of basic theories; exact and approximate methods of solution of radiative heat transfer and the interaction of radiation with conductive and convective modes of heat transfer in participating and non-participating media.

MAE 614 Mechanical Transients and Machine Vibrations. *Preq.: MAE 513. 3(3-0) S.* Forces and motions produced in mechanical systems by periodic transient inputs including shock and impact loading. Application to lumped mass and continuous systems including plates and shells.

MAE 615 Nonlinear Vibrations. *Preq.: MAE 513. 3(3-0) S. Alt. yrs.* A study of free and forced vibrations of non-linear systems with non-linear restoring forces and self-sustained oscillations. Various analytical and phase plane methods are developed and used in obtaining actual solutions. Emphasis is placed on understanding properties unique to non-linear systems.

MAE 618 Acoustic Radiation II. *Preq.: MAE 518. 3(3-0) S.* Advanced treatment of the theory of sound generation and transmission. Topics include: techniques for solution of the wave equation, radiation from spheres, cylinders and plates, sound propagation in ducts, scattering.

MAE 619 Random Vibration. *Preq.: MAE 513. 3(3-0) F. Alt. yrs.* Mathematical description of stochastic processes. The stationary and ergodic assumptions and response analysis of mechanical systems to random excitation. Simulation of and failure due to random environments.

MAE 623 Mechanics of Machinery. *Preqs.: MAE 315, MA 512. 3(3-0) S. Alt. yrs.* Advanced applications of dynamics to the design and response analysis of dynamic behavior of machines and mechanical devices. Emphasis on developing competence in transforming real problems in dynamics into appropriate mathematical models whose analysis permits performance predictions of engineering value.

MAE 640 Advanced Machine Design II. *Preqs.: MAE 541 and CI. 3(3-0) S.* A continuation, at the advanced level, of MAE 541, Advanced Machine Design I.

MAE 642 Mechanical Design Analysis. *Preq.: Nine hours of graduate credit in MAE. 3(3-0) F.* Lecture and project activity devoted to development of the ability to apply knowledge and experience in performing comprehensive design analysis of complete mechanical systems. Areas of interest to include critical problem recognition, system modeling, performance determination and optimization and reliability evaluation.

MAE 643 Mechanical Design Synthesis. *Preq.: MAE 642. 3(2-2) S.* Application of the basic philosophy and methodology of the complete design process to advanced mechanical system design. Individual and group experience in the conception, synthesis, analysis, op-

timization and implementation phases of feasibility, preliminary and final design studies; provided by means of comprehensive system design projects.

MAE (OR) 646 Variational Methods in Optimization Techniques II. *3(3-0) Alt. F,S.* (See operations research.)

MAE 654 Dynamics of Real Fluids I. *Preq.: MAE 550 or 557. 3(3-0) S.* Exact solutions to the Navier-Stokes equations. Approximate solutions for low Reynolds numbers. Approximate solutions for high Reynolds numbers—incompressible boundary layer theory. Laminar and turbulent boundary layers in theory and experiment. Flow separation.

MAE 655 Dynamics of Real Fluids II. *Preq.: MAE 654. 3(3-0) F.* A continuation of MAE 654. Compressible laminar and turbulent boundary layers. Laminar and turbulent jets. The stability of laminar boundary layers with respect to small disturbances, transition from laminar to turbulent flow.

MAE 656 Turbulence. *Preq.: MAE 550. 3(3-0) S.* A development of the basic concepts and governing equations for turbulence and turbulent field motion. Formulations of the various correlation tensors and energy spectra for isotropic and nonisotropic turbulence. An introduction to turbulent transport processes, "free" turbulence, and "wall" turbulence.

MAE 658 Plasmagasdynamics II. *Preq.: MAE 558. 3(3-0) S.* Quantum statistics and ionization phenomena. Charged particle interactions. Transport properties in the presence of electric and magnetic fields and nonequilibrium ionization.

MAE 659 Molecular Gas Dynamics II. *Preqs.: MAE 559, 601. 3(3-0) S.* A continuation of MAE 559. Approximate methods of solution to the Boltzmann equation. Modeling of the Boltzmann equation. Results obtained by the various methods of analysis.

MAE 661 Introduction to Rocket Propulsion. *Preq.: MAE 501. 3(3-0) F.* Review of the exterior ballistics and performance of rocket-propelled vehicles. Thermodynamics of real gases at high temperatures. Nonequilibrium flow in rocket nozzles.

MAE 662 Chemical Propulsion. *Preq.: MAE 661. 3(3-0) S. this course will cover solid or liquid propellant rockets, and deal* Depending upon student interest, with combustion of propellants, combustion instabilities and the design and performance of solid or liquid propellant engines.

MAE (MEA) 663 Advanced Geophysical Fluid Mechanics. *3(3-0) S. Alt. yrs.* (See marine, earth and atmospheric sciences.)

MAE (MEA) 664, 665 Perturbation Method in Fluid Mechanics I, II. *3(3-0) F,S.* (See marine, earth and atmospheric sciences.)

MAE 686 Advanced Topics in Mechanical Engineering. *Preq.: Grad. standing. 1-3 F,S.* Faculty and graduate student discussions of advanced topics in contemporary mechanical engineering.

MAE 695 Mechanical Engineering Seminar. *1(1-0) F,S.* Faculty and graduate student discussions centered around current research problems and advanced engineering theories.

MAE 699 Mechanical Engineering Research. *Preqs.: Grad. standing in mechanical engineering, consent of adviser. Credits Arranged.* Individual research in the field of mechanical engineering.

Microbiology

GRADUATE FACULTY

Professor L. W. Park, *Head*

Professor Emeritus J. B. Evans, *Graduate Administrator*

Professors: W. J. Dobrogosz, G. H. Elkan, J. J. Perry; *Adjunct Professor:* R. E. Kanich; *Associate Professors:* R. E. Johnston, G. H. Luginbuhl, J. M. Mackenzie Jr., T. Melton; *Associate Professor (USDA):* P. E. Bishop; *Adjunct Associate Professor:* D. H. King; *Adjunct Assistant Professor:* W. S. Dallas

ASSOCIATE MEMBERS OF THE DEPARTMENT

Professors: P. B. Hamilton, W. E. Kloos, J. G. Lecce; *Associate Professors:* E. V. De Buysscher, H. M. Hassan, T. R. Klaenhammer; *Adjunct Associate Professor:* K. T. Kleeman; *Assistant Professors:* W. G. Dougherty, P. E. Orndorff

The Department of Microbiology offers programs leading to the Master of Science and Doctor of Philosophy degrees. These are research oriented programs that require a dissertation based on personal research. For students wishing a more general education without the thesis requirement, the Master of Life Sciences degree is offered with an emphasis in microbiology.

Applicants should have a bachelor's degree in one of the biological or physical sciences including at least one course in microbiology and courses in organic chemistry and calculus. Deficiencies may be made up while in graduate school but will not be counted as credit toward a graduate degree.

There are no specific departmental requirements regarding courses of study. There is a core of basic courses in microbiology that will be in the programs of most graduate students who have not had equivalent courses previously. As many as half of the courses in most programs will be basic courses in related areas such as biochemistry, chemistry, genetics or toxicology.

At least one semester of half-time teaching experience is required of all Ph.D. candidates. All graduate students are expected to attend and participate in the seminar program every semester they are in residence. As a general rule the M.S. program requires two full years (including summers) beyond the B.S. level and the Ph.D. program requires two or three full years beyond the M.S. level.

SELECTED ADVANCED UNDERGRADUATE COURSES

MB 401 General Microbiology. *Preqs.: BS 100; CH 223 or CH 220. 4(3-3) F,S.*

MB (FS) 405 Food Microbiology. *Preq.: MB 401. 3(2-3) F.*

MB 411 Medical Microbiology. *Preq.: MB 401. 4(3-3) S.*

MB 490 Special Topics in Microbiology. *Preqs.: Three courses in MB and CI. 1-3 F,S,Sum.*

MB 491 Seminar in Microbiology. *Preq.: Jr. standing. 1(1-0) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

MB 501 A,B,C Advanced Microbiology I (A-Metabolism; B-Physiology; C-Immunology). *Preq.: MB 401. 1-3 F.* Basic concepts and principles of three major areas of microbiology presented as a series of five-week minicourses: MB 501A, metabolism; MB 501B, physiology; MB 501C, immunology. Graduate students majoring in microbiology must take all sections or have equivalent knowledge. Others may enroll for specific minicourses.
Dobrogosz, Hassan, Lecce

MB 502A,B,C Advanced Microbiology II (A-Systematics; B-Virology; C-Pathogenesis). *Preq.: MB 401. 1-3 S.* Basic concepts and principles of three major areas of microbiology presented as a series of five-week minicourses: MB 502A, systematics; MB 502B, virology; MB 502C, pathogenesis. Graduate students majoring in microbiology must take all sections or have equivalent knowledge. Others may enroll for specific minicourses.
Evans, Johnston, Luginbuhl

MB 503 Microbial Ecology. *Preq.: MB 401. 3(2-3) F.* An integrated treatment of all aspects of biological changes in habitats brought about by microorganisms. The physiological and biochemical approach will be stressed.
Elkan

MB (FS) 506 Advanced Food Microbiology. *3(1-6) S.* (See food science.)

MB 511 Industrial Microbiology. *Preqs.: BCH 451 and MB 401. 1(1-0) S.* Concepts, principles and procedures involved in the industrial production of useful chemicals by microbial fermentation. Screening methods for selection and evaluation of inoculum cultures, the potential role of genetic engineering and practical considerations in implementing a profitable fermentation process will be discussed, with examples from currently operational fermentations.
Perry

MB 514 Microbial Metabolic Regulation. *Preqs.: MB 401, BCH 451 or BCH 551. 3(3-0) S.* An integrative perspective on bacterial physiology and metabolism through an analysis of metabolic regulatory functions.
Dobrogosz

MB (SSC) 532 Soil Microbiology. *4(3-3) S.* (See soil science.)

MB 551 Immunology. *Preq.: MB 501C or equivalent. 3(3-0) S.* Principles of the immune mechanism of man and animals; interactions between cells of the immune system and their genetic basis; the molecular basis of the generation of diversity and selective processes in the immune system.
De Buysscher, Tonkonogy

MB (ZO) 555 Protozoology. *4(2-6) S.* (See zoology.)

MB (BAE, CE) 570 Sanitary Microbiology. *3(2-3) S.* (See civil engineering.)

MB 571 Molecular Virology of Animal Viruses. *Preqs.: BCH 551, MB 401. 3(3-0) F.* Animal virus replication. Selected examples from each virus group illustrate the principles underlying lytic, persistent and tumor-inducing viral infection.
Johnston

MB (BO) 574 Phycology. *3(1-4) S.* (See botany.)

MB (BO, PP) 575 The Fungi. *3(3-0) F.* (See botany.)

MB (BO, PP) 576 The Fungi—Lab. *1(0-3) F.* (See botany.)

MB 590 Topical Problems. *Preqs.: Grad. standing, CI. Credits Arranged. F.S.*
Graduate Staff

FOR GRADUATES ONLY

MB (SSC) 632 Ecology and Functions of Soil Microorganisms. 3(3-0) S. (See soil science.)

MB 660 Experimental Microbial Genetics. *Preqs.: BCH 561, GN 411, MB 401. 4(2-6) F.* Laboratory-oriented presentation of current methodologies and concepts in molecular microbial genetics and their application to strain construction, plasmid and phage manipulations, mutagenesis, cloning and genetic engineering of microorganisms. Melton

MB 671 Molecular Virology of Animal Viruses. *Preqs.: BCH 551, MB 502B. 3(3-0) F.* Animal virus replication. Selected examples from each virus group illustrate the principles underlying lytic, persistent and tumor-inducing viral infection. Johnston

MB 690 Microbiology Seminar. 1(1-0) F,S. Graduate Staff

MB 692 Special Problems in Microbiology. *Credits Arranged. F,S,Sum.* Graduate Staff

MB 699 Microbiology Research. *Credits Arranged. F,S,Sum.* Graduate Staff

Nuclear Engineering

GRADUATE FACULTY

Professor P. J. Turinsky, Head

Professor K. L. Murty, Graduate Administrator

Professors: R. P. Gardner, R. F. Saxe, C. E. Siewert, K. Verghese; Professors Emeriti: R. L. Murray, E. Stam, L. R. Zumwalt; Associate Professors: J. G. Gilligan, K. L. Murty; Visiting Associate Professor: O. H. Auciello; Assistant Professor: J. M. Doster

The discipline of nuclear engineering is concerned with the development of nuclear processes for energy production and with the applications of radiation for the benefit of society. The Department of Nuclear Engineering offers graduate study via courses and research leading to the Master of Nuclear Engineering, Master of Science and Doctor of Philosophy degrees.

Representative topics of investigation include nuclear, analytic, computational and experimental research in the neutronics, materials and thermal-hydraulics of aspects of fission reactors; radiation detection and measurement of basic physics parameters; applications of radioisotopes and radiation in industry, medicine and science; and plasma, plasma-material surface interactions and fuel cycles aspects of fusion reactors.

The department's one-megawatt PULSTAR reactor, which became operational in 1973, is similar in design, type of fuel and performance to modern power reactors. It is used for teaching, research and service in behalf of the University. Also available for student use in research are radiation detection laboratories, NAA laboratory, nuclear materials laboratory, plasma and plasma-surface interaction

laboratory, prompt gamma facility, neutron radiography unit, NMR facility noise analysis equipment, IBM Model 3081 computer, VAX/750 minicomputer, many microcomputers and several other well-equipped laboratories.

Bachelor's degree graduates in any of the fields of engineering or physical sciences may be qualified for successful advanced study in nuclear engineering. Prior experience or course work in nuclear physics, differential equations and basic reactor analysis is helpful but may be gained during the first semester of graduate study.

Teaching assistantships, research assistantships and fellowships are available for qualified applicants. Opportunities are also available for graduate traineeships with utility companies and reactor manufacturers, providing a valuable combination of financial support and learning in the classroom, the research laboratory and on the job.

Thirty semester hours are required for the Master of Nuclear Engineering and M.S. degrees. Students may also work directly toward a Ph.D. degree. Interdisciplinary programs with other departments in the School of Engineering and the School of Physical and Mathematical Sciences are available.

The advent of competitive nuclear power and the ever-increasing need for reliable clean energy has created a strong demand for nuclear engineers to participate in all phases of the nuclear power field—environmental studies, siting, design, construction, testing, operation, licensing and evaluation. Graduates of the department find positions in industry, government and educational institutions, working with reactors in the several categories—thermal, fast breeder and fusion.

SELECTED ADVANCED UNDERGRADUATE COURSES

NE 401 Reactor Analysis and Design. *Req.: C or better in NE 301. 4(3-2) S.*

NE 402 Reactor Engineering. *Reqs.: NE 302, MA 401. 4(3-2) F.*

NE 403 Nuclear Engineering Design Projects. *Reqs.: NE 401, NE 402. 3(2-3) S.*

NE 404 Radiological, Reactor, and Environmental Safety. *Req.: NE 302 or NE 419. 3(3-0) S.*

NE 405 Reactor Systems. *Req.: NE 402. 3(3-0) F.*

NE (MAT) 409 Nuclear Materials. *Req.: MAT 201. 2(2-0) S.*

NE 412 Nuclear Fuel Cycles. *Req.: NE 302. 3(3-0) S.*

NE 414 Nuclear Power Plant Instrumentation. *Reqs.: NE students—ECE 331, 332; ECE students—NE 419. 3(3-0) S.*

NE 419 Introduction to Nuclear Engineering. *Req.: PY 202 or PY 208. 3(3-0) F.*

NE 491 Special Topics in Nuclear Engineering. *Req.: CI. 1-4 F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

NE 508 Radiation Safety. *Preq.: NE 401 or NE 520. 3(2-3) S.* Presents the basic concepts of health physics, biological effects of radiation and calculation of radiation exposure. Topics include: radiation units, regulatory agencies and allowable limits of radiation, sources of radiation, dose calculations—external and internal, radiation dosimetry, reactor radiation sources and dose reduction with particular emphasis on shielding. Mani, Wehring

NE (PY) 511 Nuclear Physics for Engineers. *3(3-0) F.* (See physics.)

NE 520 Radiation and Reactor Fundamentals. *Preqs.: MA 401 and NE 401 or equivalent. 2(2-0) F.* An introduction to radiation physics and reactor physics. Topics include atomic and nuclear decay processes, nuclear reactions, neutron slowing down and diffusion, criticality for bare and reflected reactors and reactor kinetics. Graduate Staff

NE 521 Nuclear Laboratory Fundamentals. *Preqs.: MA 401 and NE 401 or equivalent. 2(1-3) F.* Introduction to nuclear instrumentation and experimental techniques used in nuclear engineering research. Topics include radiation detection and spectroscopy, neutron instrumentation, statistical analysis, use of microcomputers and nuclear reactor operations. Verghe, Wehring

NE 522 Reactor Dynamics and Control. *Preq.: NE 401 or NE 520. 3(3-0) F.* Introduces the students to methods of describing and analyzing dynamic behavior of systems. These methods are applied to reactor systems and the effects of feedback studies. Methods of measuring the behavior of reactor systems are described and logic systems for control and safety are developed. Saxe

NE 523 Reactor Analysis. *Preq.: NE 401 or NE 520; Coreq.: NE 527. 3(3-0) F.* Basic models of neutron motion and methods of calculating neutron flux distributions in nuclear reactors. Emphasis on multigroup diffusion theory. Criticality search, neutron slowing down models, resonance absorption, thermalization and heterogeneous cell calculations. Objective is to enable students to read literature and perform relevant analysis in reactor physics. Verghe

NE 524 Reactor Heat Transfer. *Preq.: NE 527. 3(3-0) S.* Considers heat generation and transfer in nuclear power reactors. Topics include reactor heat generation, steady-state and transient heat conduction in reactor fuel elements, boiling heat transfer and single and two-phase flow. Doster, Turinsky

NE (MAT) 525 Nuclear Materials. *Preqs.: NE 409 or MAT 201, CI. 3(3-0) F.* Introduces students to properties and selection of materials for nuclear steam systems and to radiation effects on materials. Implications of radiation damage to reactor materials and material problems in nuclear engineering are discussed. Topics include an overview of nuclear steam systems, crystal structure and defects, dislocation theory, mechanical properties, radiation damage, hardening and embrittlement due to radiation exposure and problems concerned with fission and fusion materials. Murty

NE 526 Radioisotopes Measurement Applications. *Preq.: NE 527. 3(3-0) S.* Introduces the student to measurement applications using radioisotopes. All the major tracing and gauging principles are discussed and several specific applications are treated in detail. Objective is to familiarize student with design and analysis of industrial measurement systems which use radioisotopes. Gardner, Verghe

NE 527 Nuclear Engineering Analysis. *Preq.: NE 401 or NE 520. 3(3-0) S.* Provides a unified view of the basic equations and techniques of radiation transport calculations. The course introduces the common analytical and numerical solution techniques used in nuclear

engineering and develops solutions for typical problems in the nuclear field. The course is intended to provide the background in analysis needed for more advanced studies in nuclear engineering. Doster, Gardner

NE 528 Principles of Fusion Reactors. *Preq.: NE 401 or NE 520. 3(3-0) S.* Provides an introduction to plasma concepts and fusion reactor design. Topics included: basics of thermonuclear reactions, charged particle collisions and radiation, plasma confinement, plasmas as fluids, formation and heating of plasmas and reactor concepts and design. Gilligan

NE 550 Laboratory Projects in Nuclear Engineering. *Preq.: NE 521. 3(1-6) F.* Enhancement of laboratory skills that are pertinent to nuclear engineering research is sought through projects that require the student to design the experiment, assemble equipment, carry out the measurements and analyze and interpret data. Students work in groups of two and perform to completion two laboratory projects. Graduate Staff

NE (MAT) 562 Materials Problems in Nuclear Engineering. *3(3-0) F.* (See materials engineering.)

NE (MAT) 573 Computer Experiments in Materials and Nuclear Engineering. *3(3-0) S.* (See materials engineering.)

NE 591, 592 Special Topics in Nuclear Engineering I, II. *Preq.: CI. 3(3-0) F.S.* Graduate Staff

FOR GRADUATES ONLY

NE 601 Reactor Theory and Analysis. *Preqs.: NE 523, 527. 3(3-0) F.* Theoretical aspects of neutron diffusion and transport related to the design computation and performance analysis of nuclear reactors. Principal topics are a unified view of the neutron cycle including slowing, resonance capture and thermalization; reactor dynamics and control; fuel cycle studies; and neutron transport methods. Background is provided for research in power and test reactor analysis. Turinsky

NE (MA) 607 Exact and Approximate Solutions in Particle Transport Theory. *Preq.: MA 501 or MA 511. 3(3-0) S.* The method of elementary solutions is used to solve exactly basic problems in neutron-transport theory and related topics. In addition, the F_N method is developed and used to establish concise approximate solutions in the realm of particle transport theory. Siewert

NE 610 Nuclear Reactor Design Calculations. *Preq.: NE 523. 3(3-0) S. Alt. yrs.* Application of the digital computer to problems in reactor core nuclear design. Available reactor core physics computer modules are studied and exercised. Systems and programs used by industry for power reactor core design and core follow are described. A review of relevant analytic and numerical methods facilitates computer program development by students. Turinsky

NE 611 Radiation Detection. *Preq.: NE 526. 3(2-2) F.* Covers the advanced aspects of radiation detection such as computer methods applied to gamma-ray spectroscopy, absolute detector efficiencies by experimental and Monte Carlo techniques, the use and theory of solid state detectors, time-of-flight detection experiments and Mossbauer and other resonance phenomena. Gardner, Verghese

NE 612 Thermal Hydraulic Design Calculations. *Preq.: NE 524. 3(3-0) F. Alt. yrs.* An advanced presentation of thermal-hydraulic analysis of nuclear power systems. Topics include development of single phase and two-phase fluid flow evaluations, subchannel analysis, models of nonnuclear components, interphase phenomena and numerical solution methods relevant to design and safety analysis codes. Doster, Turinsky

NE 620 Nuclear Radiation Attenuation. *Preqs.: NE 508, 527. 3(3-0) F.* The physical theory and mathematical analysis of the penetration of neutrons, gamma-rays and charged particles. Analytical techniques include point kernels, transport theory, Monte Carlo and numerical methods. Digital computers are employed in the solution of practical problems.

Doster, Stewart

NE 621 Radiation Effects on Materials. *Preq.: NE 525. 3(3-0) F.* Interactions of radiation with matter, with emphasis on the physical effects. Current theories and experimental techniques are discussed. Annealing of defects, radiation induced changes in physical properties and effects in reactor materials are discussed.

Murty

NE 631 Reactor Kinetics and Control. *Preq.: NE 522. 3(3-0) S.* A study of the control of nuclear reactor systems. Basic control theory is developed including the use of Bode, Nyquist and S-plane diagrams and state-variable methods. Reactor and reactor systems are analyzed by these methods and control methods and optimum-control methods are developed. Models for reactors and reactor-associated units, such as heat exchangers, are discussed. The effects of non-linearities are presented.

Saxe

NE 641 Radioisotopes Applications. *Preq.: NE 526. 3(3-0) F.* Principles and techniques of radioisotope applications are presented. Topics include radiotracer principles, radiotracer applications to engineering processes, radioisotope gauging principles and charged particle, gamma ray and neutron radioisotope gauges.

Gardner, Verghese

NE 653 Power Plant Engineering and Safety Analysis. *Preqs.: NE 522, 524. 3(3-0) F.* Detailed discussion of project engineering, safety analysis licensing and regulations that pertain to the procurement and operation of nuclear power systems.

Turinsky

NE 691, 692 Advanced Topics in Nuclear Engineering I, II. *Preq.: CI. 3(3-0) F.S.* A study of recent development in nuclear engineering theory and practice.

Graduate Staff

NE 695 Seminar in Nuclear Engineering. *1(1-0) F.S.* Discussion of selected topics in nuclear engineering.

Graduate Staff

NE 699 Research in Nuclear Engineering. *Preq.: Grad. standing. Credits Arranged.* Individual research in the field of nuclear engineering.

Graduate Staff

Nutrition

GRADUATE FACULTY

Professor J. D. Garlich, Coordinator

Professors: L. W. Aurand, A. J. Clawson, W. E. Donaldson, R. W. Harvey, C. H. Hill, H. N. Jacobson, W. L. Johnson, E. E. Jones, C. A. Lassiter, J. M. Leatherwood, J. G. Lecce, D. R. Lineback, R. D. Mochrie, A. H. Rakes, H. A. Ramsey, H. E. Swaisgood, S. B. Tove; *Professors Emeriti:* E. R. Barrick, E. S. Cofer, F. H. Smith, G. H. Wise; *Associate Professors:* G. L. Catignani, W. J. Croom, J. C. H. Shih, J. W. Spears; *Associate Professor Emeritus:* J. J. McNeill

Graduate study leading to either a Master of Science or a Doctor of Philosophy degree in nutrition may be taken in the interdepartmental nutrition program. Participating departments include animal science, biochemistry, food science and poultry science. Students reside and conduct research in one of these departments

under the direction of an appropriate advisor. Co-majors involving a participating department or related discipline are permitted. Minors may be biochemistry, microbiology, physiology, statistics or other approved graduate field.

Research in the nutrition program is conducted with a variety of species and at levels ranging from the molecular to the whole animal. The approach, therefore, is frequently both fundamental and comparative. Research facilities in each department are extensive and the problems under investigation are many and varied. Additional information about the program may be obtained by writing to Dr. J. D. Garlich, Coordinator, Nutrition Program, P.O. Box 7608, North Carolina State University, Raleigh, North Carolina 27695-7608.

SELECTED ADVANCED UNDERGRADUATE COURSES

NTR (ANS, PO) 415 Comparative Nutrition. *Preq.: CH 220 or both 221 and 223. 3(3-0) F.*

NTR (ANS) 419 Human Nutrition in Health and Disease. *Preqs.: BCH 451, NTR (ANS, PO) 415 or FS 400. 3(3-0) S.*

Associated courses related to nutrition are:

FS 400 Foods and Nutrition. *Preq.: CH 220. 3(3-0) F.*

FS 402 Food Chemistry. *Preq.: CH 220 or CH 221. 3(2-3) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

NTR (ANS) 516 Quantitative Nutrition. *Preq.: BCH 451 or NTR (ANS) 415 or NTR (ANS) 419 or FS 400. 3(1-6) S.* The quantitative evaluation of dietary ingredients and the determination of nutrient utilization. Exploration of the quantitative principles of nutrition through the use of laboratory animals and microorganisms. Johnson

NTR (ANS) 540 Ruminant Physiology and Metabolism. *3(3-0) F. Even yrs. (See animal science.)*

NTR 590 Topical Problems in Nutrition. *Preq.: Grad. or sr. standing. 1-6 F/S.* Analysis of current problems in nutrition. Also entails the scientific appraisal and solution of a selected problem designed to provide training and experience in research. Graduate Staff

FOR GRADUATES ONLY

NTR 601 Protein and Amino Acid Metabolism. *Preqs.: BCH 551, ZO 421, a 400-level nutrition course. 3(3-0) S.* Protein and amino acid metabolism, regulation, dietary requirements and techniques for their investigation in human and other animals are studied. Garlich

NTR (ANS, PO) 605 Mineral Metabolism. *3(3-0) F. (See animal science.)*

NTR (FS) 606 Vitamin Metabolism. *Preqs.: ANS (NTR, PO) 415 and BCH 551. 2(2-0) F.* Structures, chemical and physical properties, functions, deficiency symptoms, distribution, absorption, transport, metabolism, storage, excretion and toxicity of the vitamins in humans and domestic animals. Nutritional significance of the essential fatty acids and the metabolism of prostaglandins, prostacyclins and leucotrienes.

Catignani, Garlich, Jones, Shih, Tove

NTR 608 Energy Metabolism. *Preqs.: BCH 551 and an introductory NTR course. 3(3-0) F. Even yrs.* This course relates biochemical and physiological events within the cell, tissue, organ and system with the nutrient needs as sources of energy for productive animal life. Digestion, absorption and metabolism of energy sources will be discussed. Processes of energy transformations within living structures will be presented in relation to energetics, biological oxidations, coupled reactions, anabolic and catabolic systems, metabolic control, partitioning and efficiency. Leatherwood

NTR 690 Advanced Special Problems in Nutrition. *Preq.: Grad. standing. 1-6 F.S.* Directed research in a specialized phase of nutrition designed to provide experience in research methodology and philosophy. Graduate Staff

NTR 699 Research in Nutrition. *Preq.: Grad. standing. Credits Arranged. F.S.* Original research preparatory to the thesis for the Master of Science or Doctor of Philosophy degree. Graduate Staff

Occupational Education

For a listing of graduate faculty and departmental information, see occupational education under education.

Operations Research

GRADUATE FACULTY

Professor S. E. Elmaghraby, Chairman and Program Director

Professors: B. B. Bhattacharyya, J. W. Bishir, J. C. Dunn, W. S. Galler, H. J. Gold, T. J. Hodgson, D. F. McAllister, E. L. Peterson, N. J. Rose, W. J. Stewart, S. Stidham Jr.; *Professor Emeritus:* B. M. Olsen; *Associate Professors:* H. A. Devine, H. J. Perros, C. J. Maday, A. A. Nilsson, H. L. W. Nuttle, T. W. Reiland; *Assistant Professors:* N. M. Bengtson, Y. Fathi, J. E. Richards, C. D. Savage, M. F. M. Stallmann

Operations research is a graduate program of a multidisciplinary nature, governed by an administrative board and the program committee, and administered through the office of the program director.

The program offers the degrees of Master of Science and Doctor of Philosophy. Both are research degrees requiring a thesis. A foreign language is not required at the master's level and is optional with the student's advisory committee at the doctoral level. A brochure is available which describes in more detail the requirements for both degrees.

An advanced program of study in operations research implies intensive study in at least two of the following areas: mathematical optimization, dynamical systems and control theory, stochastic systems, econometrics and economic decision theory and information and cybernetics.

For students who wish to combine their study in OR with studies in another field, the program offers a joint program at the Ph.D. level with a minor in com-

puter studies and other joint programs at the M.S. level with management. Furthermore, the OR program encourages co-majoring with mathematics, statistics or any field of science and engineering. Please consult the OR brochure for more details.

SELECTED ADVANCED UNDERGRADUATE COURSE

OR 493 Special Topics in Operations Research. *Preqs.: Jr. or sr. standing; MA 112. 1-3 F,S,Sum.*

CENTRAL COURSES

FOR GRADUATES AND ADVANCED UNDERGRADUATES

OR 501 Introduction to Operations Research. *Preqs.: MA 421 or ST 421 or ST 371 and ST 372. 3(3-0) F,S.* OR Approach: modeling, constraints, objective and criterion. The problem of Multiple criteria. Optimization, Model validation. The team approach. Systems Design. Examples, OR Methodology: mathematical programming; optimum seeking; simulation, gaming; heuristic programming. Examples. OR Applications; theory of inventory; economic ordering under deterministic and stochastic demand. The production smoothing problem; linear and quadratic cost functions. Waiting line problems: single and multiple servers with Poisson input and output. The theory of games for two-person competitive situations. Project management through PERT-CPM. Elmaghraby

OR (IE, MA) 505 Linear Programming. *Preq.: MA 405. 3(3-0) F,S.* An introduction including: applications to economics and engineering; the simplex method and its main variants; parametric programming and post-optimality analysis; duality matrix games, linear systems solvability theory and linear systems duality theory; polyhedral sets and cones, including their convexity and separation properties and dual representations; equilibrium prices, Lagrange multipliers, subgradients and sensitivity analysis. Peterson

OR 506 Algorithmic Methods in Nonlinear Programming. *Preqs.: MA 301, MA 405, knowledge of computer language, such as FORTRAN or PL1. 3(3-0) S.* Introduction to methods for obtaining approximate solutions to unconstrained and constrained minimization problems of moderate size. Emphasis on geometrical interpretation and actual coordinate descent, steepest descent, Newton and quasi-Newton methods, conjugate gradient search, gradient projection and penalty function methods for constrained problems. Specialized problems and algorithms will be treated as time permits. Reiland

OR (IE) 509 Dynamic Programming. *Preqs.: MA 405, ST 421. 3(3-0) S.* An introduction to the theory and computational aspects of dynamic programming and its application to sequential decision problems. Elmaghraby, Stidham

OR 520 Theory of Activity Networks. *Preqs.: OR 501, OR (IE, MA) 505. 3(3-0) S. Alt. yrs.* Introduction to graph theory and network theory. A discussion in depth of the theory underlying (1) deterministic activity networks (CPM): optimal time-cost trade offs; the problem of scarce resources; (2) probabilistic activity networks (PERT): critical evaluation of the underlying assumptions; (3) generalized activity networks (GERT, GAN): applications of signal flow graphs and semi-Markov process to probabilistic branching; relation to the theory of scheduling. Elmaghraby

OR (CHE) 527 Optimization of Engineering Processes. *Preqs.: CHE 451 or OR 501, FORTRAN programming. 3(3-0) F.* The formulation and solution of process optimization problems, with emphasis on nonlinear programming techniques. Computer implementation of optimization algorithms and structuring of process models to increase computational efficiency. Felder

OR (E, MA) 531 Dynamical Systems and Multivariable Control. *Preqs.: MA 301, 405 or equivalent, 3(3-0)* *F.* Introduction to analytical modeling, control and optimization of dynamical systems based on state space and transfer function descriptions. Emphasis on linear, continuous-time and discrete-time systems. Topics include state variables, transforms, flow graphs, canonical forms, system response, stability, controllability and observability, modal control, non-interacting control, observers, fundamental concepts of optimal control and estimation. Multidisciplinary applications chosen from biological, chemical, economic, electrical, mechanical and sociological systems. Dunn

OR (MAE) 545 Variational Methods in Optimization Techniques I. *Preqs.: MA 511, MA 512, 3(3-0)* *F. Alt. yrs.* Variational methods are applied to optimization problems in engineering, where examples are drawn from flight mechanics, operations research, heat transfer, structures and aerodynamics. The necessary conditions which follow from the general variation of a functional are developed. Solutions with corners and discontinuities are considered. Inequality constraints on control variables and constrained extrema are also considered. Gradient methods are described. Maday

OR (IE) 561 Queues and Stochastic Service Systems. *Preq.: MA 421, 3(3-0)* *F.* General concepts of stochastic processes are introduced. Poisson processes, Markov processes, and renewal theory are presented. These are then used in the analysis of queues, starting with a completely memoryless queue to one with general parameters. Applications to many engineering problems will be considered. Nilsson, Stidham

OR (CSC, CSE, ECE, IE) 562 Computer Simulation Techniques. *3(3-0)* *F.* (See computer studies.)

OR (CSC, MA) 585 Graph Theory. *Preq.: MA 231 or 405, 3(3-0)* *F.* Basic concepts of graph theory. Trees and forests. Vector spaces associated with a graph. Representation of graphs by binary matrices and list structures. Traversability. Connectivity. Matchings and assignment problems. Planar graphs. Colorability. Directed graphs. Applications of graph theory with emphasis on organizing problems in a form suitable for computer solution. Savage

OR (IE, MA) 586 Network Flows. *Preq.: OR (IE, MA) 505 or equivalent, 3(2-2)* *S. Alt. yrs.* This course will study problems of flows in networks. These problems will include the determination of the shortest chain, maximal flow and minimal cost flow in networks. The relationship between network flows and linear programming will be developed as well as problems with nonlinear cost functions, multi-commodity flows and the problem of network synthesis. Nuttle

OR 591 Special Topics in Operations Research. *Preq.: CI. 1-3 F,S,Sum.* Individual or small group studies of special areas of OR which fit into the students' programs of study and which may not be covered by other OR courses. Furthermore, the course serves as a vehicle for introducing new or specialized topics at the introductory graduate level. Graduate Staff

FOR GRADUATES ONLY

OR (CSC) 605 Large Scale Linear Programming Systems. *Preqs.: OR 505 and FORTRAN programming experience, 3(3-0)* *Alt. S.A* study of the specialized algorithms for the efficient solution of large scale LP problems. Includes: parametric programming, bounded variable algorithms, generalized upper bounding, decomposition, separable programming and mixed integer programming. Emphasis is on gaining firsthand practical experience with current computer codes and computational procedures. McAllister

OR (MA, ST) 606 Nonlinear Programming. *Preq.: OR (IE, MA) 505, 3(3-0)* *S.* This course provides an advanced mathematical treatment of the analytical and algorithmic aspects of finite dimensional nonlinear programming. It includes an examination of the structure and

effectiveness of computational methods for unconstrained and constrained minimization. Special attention will be directed toward current research and recent developments in the field.

Peterson, Reiland

OR 609 Advanced Dynamic Programming. *Preqs.: OR 509, MA 541. 3(3-0) F. Alt. yrs.* Introduction to measure theoretic concepts, review of finite state Markov processes, theory of Markovian programming, discrete decision processes, continuous time dynamic programming, relation to calculus of variation and the Maximum Principle. Emphasis throughout is on recent theoretical development in the field. (Offered in alt. years.)

Elmaghraby, Stidham

OR (BMA) 611 System Modeling Theory. *3(3-0).* (See biomathematics.)

OR (MA) 614 Integer Programming. *Preqs.: MA 405, OR (MA, IE) 505; Coreq.: Some familiarity with computers (e.g., CSC 111). 3(3-0) S. Alt. yrs.* Study of general integer programming problems and principal methods of solving them. Emphasis on intuitive presentation of ideas underlying various algorithms rather than detailed description of computer codes. The students will have some "hands on" computing experience that should enable them to adapt the ideas presented in the course to integer programming problems they may encounter.

Graduate Staff

OR (MA) 629 Vector Space Methods in System Optimization. *Preqs.: MA 405, 511 or equivalent. 3(3-0) F.* Introduction to algebraic and function-analytic concepts used in system modeling and optimization: vector space, linear mappings, spectral decomposition, adjoints, orthogonal projection, quality, fixed points and differentials. Emphasis on geometric insight. Topics include least square optimization of linear systems, minimum norm problems in Banach space, linearization in Hilbert space, iterative solution of system equations and optimization problems. Broad range of applications in operations research and system engineering including control theory, mathematical programming, econometrics, statistical estimation, circuit theory and numerical analysis.

Dunn

OR (MAE) 646 Variational Methods in Optimization Techniques II. *Preq.: OR (MAE) 545. 3(3-0) S. Alt. yrs.* Variational methods are applied to optimization problems in engineering, where examples are drawn from flight mechanics, operations research, heat transfer, structures and aerodynamics. The necessary conditions which follow from the general variation of a functional are developed. Solutions with corners and discontinuities are considered. Inequality constraints on control variables and constrained extrema are also considered. Gradient methods are described.

Maday

OR (E) 650 Algorithmic Methods in Optimal Control. *Preq.: OR 629 or equivalent; Coreq.: Knowledge of higher level language (e.g., FORTRAN or PL1). 3(3-0) S. Alt. yrs.* Study of computational methods for optimal control of dynamical systems. Emphasis on extensions of nonlinear programming to control problems described by differential and difference equations. Topics include linear systems with quadratic objective, gradient and dynamic programming algorithms for nonlinear control problems, methods for treating control and state constraints, and an introduction to optimization of delay and distributed parameter systems. The course will include computational exercises based on applications from OR and engineering.

Dunn

OR (CSE,IE) 662 Stochastic Simulation Design and Analysis. *3(3-0) S.* (See computer studies.)

OR 691 Special Topics in Operations Research. *Preqs.: OR 501, OR (IE, MA) 505. 3(3-0) F,S,Sum.* The purpose of this course is to allow individual students or small groups of students to take on studies of special areas in OR which fit into their particular program and which may not be covered by other OR courses. The work will be directed by a qualified faculty member and in some instances by visiting professors. The subject matter in any year is dependent on the students and the faculty members.

Graduate Staff

OR (IE, MA) 692 Special Topics in Mathematical Programming. *Preqs.: OR (IE, MA) 505, 3(3-0) F,S,Sum.* The study of special advanced topics in the area of mathematical programming. New techniques and current research in this area will be discussed. The faculty responsible for this course will select according to their preference and interest the areas to be covered during the semester. This course will not necessarily be taught by an individual faculty but can, on occasion, be a joint effort of several faculty members from this University as well as visiting faculty from other institutions. To date, courses on Theory of Networks, Optimal Control Algorithms and Integer Programming have been offered under the umbrella of this course. It is anticipated that these topics will be repeated in the future, together with other topics.

Graduate Staff

OR 695 Seminar in Operations Research. *Preq.: Enrollment in OR as a major or minor, 1(1-0) F,S,* and reports. Graduate students with minors or majors in operations research are expected to attend throughout the period of their residence.

Graduate Staff

OR 699 Project in Operations Research. *Preq.: Variable, 1-3 F,S,Sum.* Individual research by graduate students minoring and majoring in operations research. Research may be done under the operations research faculty member meeting the interest need of the student.

Graduate Staff

SUGGESTED COGNATE COURSES

Cognate courses in the operations research program are courses often included in programs of study but which carry other departmental designations. They cover subject matter closely related to operations research and provide additional insight into the basis or application of operations research techniques. Students should not assume they will be able to include any of the cognate courses in their own program of study unless they have made previous arrangements with their faculty advisor.

Biomathematics

BMA (MA, ST) 571, 572 Biomathematics I & II

Chemical Engineering

CHE 525 Chemical Process Control

Civil Engineering

CE 575 Civil Engineering Systems

Computer Science

CSE (MA) 529, 530 Numerical Analysis I, II

CSC (MA) 582 Numerical Linear Algebra

CSC (MA) 583 Numerical Solution of Ordinary Differential Equations

CSC (MA) 584 Numerical Solution of Partial Differential Equations—Finite Difference Methods

CSE (CSC,ECE) 671 Computer Systems Performance Evaluation

Economics and Business

EB 650 Economic Decision Theory

EB (ST) 651 Econometrics

EB (ST) 652 Topics in Econometrics

Electrical and Computer Engineering

ECE 516 System Control Engineering
ECE (CSE) 521 Digital Computer Technology and Design
ECE 691 Special Studies in Electrical Engineering

Industrial Engineering

IE 523 Production Planning, Scheduling and Inventory Control
IE 547 Reliability and Quality Assurance
IE 553 Materials Handling Systems
IE 611 The Design of Production Systems
IE 622 Inventory Control Methods II

Mathematics

MA (ST) 541 Theory of Probability I
MA (ST) 542 Introduction to Stochastic Processes
MA (ST) 617, 618 Measure Theory and Advanced Probability
MA (ST) 619 Topics in Advanced Probability
MA 622 Linear Transformations and Matrix Theory
MA 623 Theory of Matrices and Applications
MA 641, 642 Calculus of Variations and Theory of Optimal Control I & II
MA 647 Functional Analysis I
MA 685 Special Topics in Numerical Analysis

Statistics

ST 583 Introduction to Statistical Decision Theory
ST 613 Time Series Analysis: Time Domain
ST 614 Time Series Analysis: Frequency Domain

Pest Management**GRADUATE FACULTY**

Associate Professor Blanche C. Haning, *Program Coordinator*

Professors: C. W. Averre III, R. C. Axtell, M. K. Beute, J. R. Bradley Jr., W. M. Brooks, G. A. Carlson, H. D. Coble, F. T. Corbin, J. M. Davis, H. J. Gold, F. P. Hain, G. G. Kennedy, W. M. Lewis, T. J. Monaco, G. C. Rock, T. J. Sheets, W. A. Skroch, R. E. Stinner, J. W. Van Duyn, A. D. Worsham; *Professor (USDA):* R. A. Reinert; *Adjunct Professor:* L. Thompson Jr.; *Associate Professors:* J. T. Ambrose, C. S. Apperson, J. S. Bacheler, R. I. Bruck, E. J. Dunphy, F. Gould, L. D. King, J. R. Meyer, D. P. Schmitt, P. S. Southern, T. B. Sutton; *Assistant Professors:* J. J. Arends, J. E. Bailey, A. R. Bonnanno, R. L. Brandenburg, D. Hoag, E. P. Lambert, H. M. Linker, M. M. Peet, G. J. San Julian

The concept of integrated pest management (IPM) combines the theoretical and practical aspects of cultural, biological and chemical control into effective systems that maintain pest populations at levels that minimize economic and environmental damage. This approach and its implementation are opening new career oppor-

tunities for broadly informed individuals who understand the basic biology and ecology of pests and the systems with which they are associated.

Graduate study in integrated pest management draws upon faculty from several departments, especially plant pathology, entomology, crop science and horticultural science. The Integrated Pest Management Teaching Subcommittee establishes the general requirements. Each student's advisory committee must include a member of the IPM graduate faculty. All programs must have the approval of the chairman of the IPM Teaching Subcommittee.

A graduate minor in pest management emphasizing agricultural crops is available for the Master of Science degree. This minor provides students with an understanding of the theory, purpose and practice of integrated pest management. Required courses or their equivalents are PM 415, Principles of Pest Management; PM 490, Pest Management Seminar or PM 595, Topical Problems in Integrated Pest Management, and at least one graduate level course each in plant pathology, entomology and weed science. A course in ecology also is recommended. This plan can also be accommodated in the Master of Agriculture degree program.

Additionally, a concentration in pest management is available within the Master of Agriculture degree and is identified by "Pest Management" on the transcript. This concentration involves a minimum of 36 credit hours and allows interdisciplinary programs of study tailored to students' needs. It includes graduate course work from at least four closely related disciplines and a minimum 3-month internship in the field. Opportunities for teaching and observing or cooperating in research are available. In the crop production and protection area the following courses or their equivalents are required: PP 515, Epidemiology and Plant Disease Control; ENT 562, Insect Pest Management in Agricultural Crops; CS(HS) 514, Principles and Methods in Weed Science; SSC 541, Soil Fertility. Deficiencies in basic course work in the crop and pest disciplines including integrated pest management will be taken in addition to these minimum requirements. Graduate students enrolled in this program are located in the department of their major professor and participate in departmental activities, including seminar.

Additional information may be obtained by contacting a member of the Graduate Faculty or the IPM Program Coordinator, 2705 Bostian Hall, Box 7611, North Carolina State University, Raleigh, North Carolina 27695-7611.

SELECTED ADVANCED UNDERGRADUATE COURSES

PM 415 Principles of Pest Management. *Preqs.: ENT 312, PP 315, BO (ZO) 360; Coreq.: CS 414. 4(3-3) F.*

PM 490 Pest Management Seminar. *Preq.: PM 415. 2(1-1) S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

PM (BO, CS, ENT, PP) 525 Biological Control. *Preqs.: ENT 312 or 425 and CS 414 or PP 315. 4(3-3) F. Odd yrs.* An interdisciplinary examination of the taxonomic and biological relationships of parasites, predators and pathogens of insects, weeds and plant pathogens, including their regulatory roles resulting from their occurrence either naturally in the environment or through human intervention. (Offered 1987-88 and alt. years.)

Brooks, Stinner, Van Dyke

PM 590 Advanced Topics in Integrated Pest Management. *Preq.: PM 405 or PM 415. 1-6 F,S,Sum.* Directed studies in Integrated Pest Management. Provides opportunity for advanced students to increase their understanding of current IPM philosophy, literature, research and technology through instruction or work experience in the field.

Graduate Staff

PM 595 Topical Problems in Integrated Pest Management. *Preq.: PM 415. 2(1-2) S.* One weekly lecture followed by discussions and projects relating to current topics in integrated pest management (IPM) under the guidance of interdisciplinary faculty teams; improves understanding of the depth and complexities of IPM and opportunities and limitations for its implementation.

Haning

Students are advised to review course listings in such relevant departments as animal science, crop science, economics and business, entomology, horticultural science, plant pathology, soil science, the biomathematics program and the School of Forest Resources.

Physics

GRADUATE FACULTY

Professor R. R. Patty, Head

Professor G. E. Mitchell, Associate Head and Graduate Administrator

Professors: K. T. Chung, W. R. Davis, W. O. Doggett, R. E. Fornes, C. R. Gould, G. L. Hall, A. W. Jenkins Jr., C. E. Johnson, G. H. Katzin, F. Lado Jr., G. Lucovsky, J. D. Memory, J. Y. Park, J. S. Risley, D. E. Sayers, J. F. Schetzina, L. W. Seagondollar, D. R. Tilley; *Professors Emeriti:* W. H. Bennett, J. T. Lynn, E. R. Manring, A. C. Menius Jr., A. W. Waltner; *Associate Professors:* G. C. Cobb Jr., S. R. Cotanch, D. G. Haase, K. L. Johnston, M. A. Klenin, J. R. Mowat, G. W. Parker III; *Adjunct Associate Professor:* W. P. Kirk II; *Associate Professor Emeritus:* D. H. Martin; *Assistant Professors:* J. W. Cook Jr., M. A. Paesler; *Research Assistant Professor:* W. B. Westerveld

ASSOCIATE MEMBERS OF THE DEPARTMENT

Professors: J. M. A. Danby, D. L. Ridgeway

Study in physics is available leading to the degrees of Master of Science and Doctor of Philosophy. In addition to the departmental VAX 11/750 computer, the facilities (including the IBM 3081D computer) of the nearby Triangle Universities Computation Center, which is jointly operated by Duke University, the University of North Carolina at Chapel Hill and North Carolina State University, are also available. These three universities also jointly staff the Triangle Universities Nuclear Laboratory located on the Duke campus. The major facilities are a 15 MeV model FN Tandem Van de Graaff accelerator with a 15 MeV cyclotron injector and on-line computer facilities.

Experimental and theoretical research is being performed in atomic and molecular physics, nuclear magnetic resonance, nuclear physics, plasma physics and solid state physics. Theoretical work is in progress in relativity and general field theory, statistical theory and astrophysics.

Programs of study leading to the Master of Science degree require a minimum of 30 semester hours; a thesis is required.

The Doctor of Philosophy degree is granted on successful completion of examinations, independent research and the submission of an acceptable dissertation. A minor area of study is required.

A large number of teaching and research assistantships is available. An out-of-state student holding such an assistantship may be eligible for reduced tuition charges.

SELECTED ADVANCED UNDERGRADUATE COURSES

PY 401, 402 Quantum Physics I, II. *Preq.: PY 411. 3(3-0) F,S.*

PY 407 Introduction to Modern Physics. *Preqs.: PY 208, MA 202. 3(3-0) F,S.*

PY 410 Introductory Nuclear Physics. *Preq.: PY 202 or 208. 4(3-2) F,S.*

PY 411, 412 Mechanics I, II. *Preqs.: PY 203 or 208, MA 301. 3(3-0) F,S.*

PY 413 Thermal Physics. *Preq.: PY 202 or 208; Coreq.: MA 301. 3(3-0) S.*

PY 414, 415 Electromagnetism I, II. *Preqs.: PY 203 or 208 and MA 301. 3(3-0) F,S.*

PY 441 Spacetime Physics. *Preq.: PY 203 or 407. 3(3-0) F.*

PY 451 Electronics for Physicists. *Preq.: PY 414; Coreq.: PY 415. 3(1-4) F,S.*

PY 452 Advanced Physics Laboratory. *Preqs.: Sr. standing and CI. 1(0-3) F,S.*

PY 499 Special Problems in Physics. *Preq.: Consent of department. 1-6 F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

PY 506 Nuclear and Subatomic Physics. *Preqs.: PY 203 or 407; PY 412. 3(3-0) F.* An introduction to nuclear and subatomic phenomena: properties of nuclear radiations and detectors, accelerators, nuclear forces and nuclear structure, elementary particles, fundamental symmetries and conservation laws. Gould

PY 508 Ion and Electron Physics. *Preq.: PY 414. 3(3-0) F.* Topics covered: charged particle dynamics, introduction to plasma physics, processes in ionized gases, electron emission and the physics of electron beams. Doggett

PY 509 Plasma Physics. *Preq.: PY 414. 3(3-0) F.* The individual and collective motion of charged particles in electric and magnetic fields and through ionized gases. Doggett

PY 510 Nuclear Physics II. *Preq.: PY 410. 4(32) S.* The properties of the atomic nucleus as revealed by radioactivity, nuclear reactions and scattering experiments with emphasis on the experimental approach. The laboratory stresses independent research and offers project work in nuclear spectroscopy and in neutron physics. Waltner

PY (NE) 511 Nuclear Physics for Engineers. *Preq.: PY 410. 3(3-0) F.* The properties of atomic nuclei, of nuclear radiations and of the interaction of nuclear radiation with matter. Emphasis on the principles of modern equipment and techniques of nuclear measurement and their application to practical problems. Waltner

PY 516 Physical Optics. *Preq.: PY 415. 3(3-0) F.* Physical optics with the major emphasis on the wave properties of light. Boundary conditions, interference and diffraction, optics of thin films, fiber optics and applications to absorption, scattering and laser operation. A background in Maxwell's equations and vector analysis is required. Johnson

PY 517 Atomic and Molecular Physics. *Preqs.: PY 401, 412. 3(3-0) S.* The quantum mechanical treatment of structure and spectra for atoms and molecules. Topics include the hydrogen atom, helium atom, multielectron atoms, selection rules, diatomic and simple polyatomic molecules and nuclear magnetic resonance spectroscopy. Mowat

PY 520 Measurements in Nuclear Physics. *Preq.: PY 410. 3(2-2) S.* Fundamentals of statistics (including the binomial, normal, Poisson and interval distributions) as applied to the analysis of measurements on nuclear reactions and radioactivity. Waltner

PY 521 Statistical Physics I. *Preqs.: PY 401, PY 413. 3(3-0) S.* The basic elements of kinetic theory and equilibrium statistical mechanics, both classical and quantum; applications of the techniques developed to various ideal models of noninteracting particles. Jenkins

PY 531 Advanced Placement Physics for Secondary School Teachers. *Preq.: Teaching certificate. 6(6-0) Sum.* A preparation for teaching advanced placement physics to high school students. A review of the physics content on the AP curriculum and discussion of teaching techniques, demonstrations and laboratories for use in such a program. Graduate Staff

PY 543 Astrophysics. *Preqs.: PY 203 or 407; PY 411. 3(3-0) S.* The basic physics necessary to investigate, from observational data, the internal conditions and evolution of stars. Topics include the formation and structure of spectral lines, methods of energy generation and transport, stellar structure, degeneracy, white dwarfs and neutron stars. Danby

PY (ECE) 552 Introduction to the Structure of Solids. *Preq.: PY 401. 3(3-0) S.* Basic considerations of crystalline solids, metals, conductors and semiconductors. Paesler

PY 553 Introduction to the Structure of Solids II. *Preq.: PY 552 or equivalent. 3(3-0) F.* A study of the properties of semiconductors, superconductors, magnets, ferroelectrics and crystalline defects and dislocations. Paesler

PY (MA) 555 Mathematical Introduction to Celestial Mechanics. *3(3-0) F.* (See mathematics.)

PY (MA) 556 Orbital Mechanics. *3(3-0) S.* (See mathematics.)

PY 561 Electronics for Physicists. *Preq.: Grad. standing. 3(1-4) S.* Analog and digital electronics laboratory course serving as an introduction to the use of modern instrumentation required for experimental research in physics. Bipolar and field effect transistors, operational amplifiers, oscillators, power supplies, analog-digital and digital-analog conversion and digital logic circuits. Cobb

PY 581, 582 Quantum Mechanics I, II. *Preqs.: MA 512; PY 411 or 414; grad. standing or permission of the graduate administrator. 3(3-0) F,S.* Fundamental concepts and formulations, including interpretation and techniques, and the application of theory to simple physical systems, such as the free particle, the harmonic oscillator, the particle in a potential well and central force problems. Other topics include approximation methods, identical particles and spin, transformation theory, symmetries and invariance, and an introduction to quantum theory of scattering and angular momentum. Johnson

PY 583 Advanced Classical Mechanics I. *Preqs.: MA 512, PY 412, PY 414; grad. standing or permission of the graduate administrator. 3(3-0) F.* An introduction to theoretical physics in preparation for advanced study. Emphasis is on classical mechanics, special relativity and the motion of charged particles. Topics include variational principles, Hamiltonian dynamics and the canonical transformation theory, structure of the Lorentz group and elementary dynamics of unquantized fields. Lado

PY 584 Advanced Classical Mechanics II. *Preqs.: PY 583; grad. standing or permission of the graduate administrator. 3(3-0) S.* Advanced classical mechanics, including continuum mechanics, fields, the group theoretical approach to dynamics and other selected topics. Katzin

PY 585, 586 Advanced Electricity and Magnetism I, II. *Preqs.: PY 415; grad. standing or permission of the graduate administrator. 3(3-0) F,S.* Topics include: techniques for the solution of potential problems, development of Maxwell's equations; wave equations, energy, force and momentum relations of an electromagnetic field; covariant formulation of electrodynamics; radiation from accelerated charges. Parker

PY 590 Special Topics in Physics. *Preq.: Consent of department. Credits arranged. F,S.* Investigations in physics under staff guidance. May consist of literature reviews, experimental or theoretical projects or special topics lectures. Graduate Staff

FOR GRADUATES ONLY

PY 600 Planetary Atmospheres. *Preq.: PY 517. 3(3-0) S.* Gas dynamics of atmospheres with emphasis on recent results of rocket, satellite and interplanetary probes. Theories of the airglow, aurora and ionosphere are developed. Graduate Staff

PY 601, 602 Theoretical Physics I, II. *Preqs.: PY 583, 586; Coreq.: MA 661. 3(3-0) F,S.* The mathematical and theoretical approach to the relationships between various branches of physics is treated. The restricted theory of relativity, electro-dynamics, classical field theory and the general theory of relativity and geometro-dynamics are considered. Davis

PY 610 Theoretical Nuclear Physics. *Preqs.: PY 506, PY 581. 3(3-0) S. Alt. yrs.* A study of theoretical methods and applications of quantum mechanics on various nuclear problems. Topics include nucleon-nucleon interaction, nuclear scattering theory, angular momentum theory (Racah algebra), polarization, theories of nuclear structure including the shell model, collective models and unified model nuclear reaction theories including compound nucleus, optical model, direct reactions, nuclear fission and nuclear fusion, energy production in stars and heavy-ion physics. Graduate Staff

PY 611 Advanced Quantum Mechanics I. *Preqs.: MA 512, PY 582. 3(3-0) F.* An introduction to the relativistic quantum theory of Dirac particles and the positron. Other topics include second quantization technique and its application to many-body problems, radiation theory and the quantization of the electromagnetic field. Chung

PY 612 Advanced Quantum Mechanics II. *Preqs.: PY 601, 611. 3(3-0) S.* A general propagator treatment of Dirac particles, photons, and scalar and vector mesons. Applications of Feynman graphs and rules will be given illustrating basic techniques employed in the treatment of electromagnetic, weak and strong interactions. Renormalization theory, the effects of radiative corrections and aspects of the general Lorentz covariant theory of quantized fields will also be considered. Chung

PY 622 Statistical Physics II. *Preq.: PY 521. 3(3-0) F.* A continuation of PY 521, with emphasis on the static and dynamic properties of real (interacting) systems. Topics will include the equilibrium theory of fluids and the linear response theory of time-dependent phenomena. Lado

PY (ECE) 627 Semiconductor Thin Films Technology. 3(3-0) S. Alt. yrs. (See electrical and computer engineering.)

PY 630, 631 Nuclear Structure Physics I, II. *Preqs.: PY 582; PY 506 or 510.* 3(3-0) F,S. Advanced description of nuclear models and nuclear reactions. Topics include: internucleon forces, compound-nucleus processes, shell model, optical model, R-matrix theory, direct reactions, collective model, electromagnetic transitions, isobaric analog states. Mitchell

PY 641 Non-Inertial Space Mechanics. *Preqs.: MA 661, PY 601; Coreq.: PY 602.* 3(3-0) S. This course treats the theoretical description of the phenomena of mechanics relating to non-inertial frames of reference, with applications to space travel and the instrumentation problems of rocketry. Applications to inertial guidance and electromagnetic-inertial coupling effects are also considered. Davis

PY 651 Mathematics of Solid-State and Many-Body Theory. *Preqs.: MA 513, PY 552, PY 582.* 3(3-0) F. Fourier techniques from solid-state theory are generalized and adapted to many areas of physics. Topics include: Fourier series in n-dimensional Bravais lattices, Fourier integrals, Schwartz distributions, Brillouin zones, Green's function, Patterson functions, convolutions and correlation coefficients. The Poisson sum formula and the theta function summation method are extensively developed for Bravais and non-Bravais lattices in n-dimensions. Hall

PY 652 Cooperative Phenomena in Solids. *Preq.: PY 651.* 3(3-0) S. Classical and quantum theories of equilibrium and transport properties of ferromagnetism, antiferromagnetism, and order-disorder in alloys. Statistical mechanics of, and phase transitions in, these and other systems are treated. Hall

PY 653 The Quantum Theory of Solids. *Preqs.: PY 521, PY 552, 582.* 3(3-0) S. Alt. yrs A survey of advanced topics in the description of condensed matter. The course is intended to provide an introduction to current theoretical research tools. Klenin

The following five courses offer opportunities for advanced study in special areas of physics under staff members working in these areas.

PY 690 Special Topics in Molecular Physics. *Preq.: CI. 1-6 F,S.*

PY 691 Special Topics in Nuclear Physics. *Preq.: CI. 1-6 F,S.*

PY 692 Special Topics in Plasma Physics. *Preq.: CI. 1-6 F,S.*

PY 693 Special Topics in Solid State Physics. *Preq.: CI. 1-6 F,S.*

PY 694 Special Topics in Theoretical Physics. *Preq.: CI. 1-6 F,S.*

PY 695 Seminar. 1(1-0) F,S. Reports on topics of current interest in physics. Several sections are offered so that students with common research interests may be grouped together. Graduate Staff

PY 699 Research. *Credits Arranged.* Graduate students sufficiently prepared may undertake research in some selected field of physics. Graduate Staff

Physiology

GRADUATE FACULTY

Professor J. H. Britt, Coordinator

Professors: R. A. Argenzio, E. V. Caruolo, F. W. Edens, L. Goode, C. H. Hill, E. Hodgson, B. H. Johnson, T. E. LeVere, I. S. Longmuir, W. D. Oxender, J. F. Roberts, M. C. Roberts, D. E. Smith, C. E. Stevens, C.-S. Teng, J. P. Thaxton, H. A. Underwood Jr.; *Professor Emeritus:* L. C. Ulberg; *Associate Professors:* J. T. Brake, V. L. Christensen, K. L. Esbenshade, R. M. Grossfeld, M. S. Hand, R. M. Petters, T. D. Siopes; *Assistant Professors:* L. M. Ballas, N. C. Olson

Graduate study under the direction of the physiology faculty may lead to the Master of Science, Master of Life Sciences and the Doctor of Philosophy degrees. The physiology faculty is an interdepartmental group drawn from the departments participating in the program. They are animal science, biochemistry, entomology, poultry science, psychology, (veterinary) anatomy, physiological sciences and radiology and zoology. The program emphasizes the comparative approach implicit in this type of organization.

Experimental facilities of the above departments are available for physiological research, as are such special facilities as the Electron Microscope Center and the Wrightsville Marine Biomedical Laboratory. Experimental animals available cover a wide range, from insects and other invertebrates to large mammals.

In addition to courses in physiology, majors in the program are expected to take selected courses in biochemistry and cell biology. Minors are usually chosen from such fields as biochemistry, entomology, genetics, statistics, toxicology and zoology. A strong basic knowledge in one of these areas is essential.

Graduate students enrolled as physiology majors are located in the department of their major professor and may participate in departmental activities.

Prerequisites for admission include a year of physics and organic chemistry, one course in biochemistry and physiology. The Aptitude Test of the Graduate Record Examination is required and the Advanced Tests in biology and chemistry are desirable.

Financial assistance for qualified students in the form of research assistantships, fellowships and traineeships is available through participating departments. Prospective students may obtain further information by writing to any one of the graduate faculty listed above or to the Coordinator, Physiology Program, Box 7621, N. C. State University, Raleigh, North Carolina 27695-7621. 7621.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

PHY (ANS) 502 Reproductive Physiology of Vertebrates. 3(3-0) S. (See animal science.)

PHY (ZO) 503 General Physiology I. *Preq.: Sr. or grad. standing.* 3(3-0) F. The general principles of homeostasis will be discussed, emphasizing the importance of integrative action. The following systems will be studied: muscular, cardiovascular and nervous systems.

Grossfeld

PHY (ZO) 504 General Physiology II. *Preq.: Sr. or grad. standing. 3(3-0) S.* The general principles of homeostasis will be discussed, emphasizing the importance of integrative action. The following will be studied: alimentary, renal, respiratory and endocrine systems.
Grossfeld

PHY (ZO) 513 Comparative Physiology. *4(3-3) S.* (See zoology.)

PHY (BCH) 553 Physiological Biochemistry. *3(3-0) S.* (See biochemistry.)

PHY (ANS) 580 Mammalian Endocrine Physiology. *3(3-0) F.* (See animal science.)

PHY 590 Special Problems in Physiology. *Preqs.: Grad. standing, CI. Credits Arranged. F,S.*
Graduate Staff

FOR GRADUATES ONLY

PHY (ANS) 604 Experimental Animal Physiology. *4(2-4) F.* (See animal science.)

PHY 690 Physiology Seminar. *Preq.: Grad. standing. 1(1-0) S.* Graduate Staff

PHY 695 Selected Topics in Physiology. *Preq.: Grad. standing. 1-4.* Graduate Staff

PHY 699 Physiological Research. *Preqs.: Grad. standing, CI. Credits Arranged. F,S.*
Graduate Staff

COURSES FROM ASSOCIATED DEPARTMENTS

BCH 551 General Biochemistry I.

GN 633 Physiological Genetics.

PO (ZO) 524 Comparative Endocrinology.

PSY 502 Physiological Psychology.

ZO 614 Advanced Cell Biology.

OTHER SUPPORTING COURSES AVAILABLE

GN (ZO) 532 Biological Effects of Radiations.

PSY 503 Comparative Psychology.

ZO 510 Animal Behavior Research Techniques.

Certain courses on the interface between physiology and engineering may be taken after consultation with adviser and the instructors concerned.

Plant Pathology

GRADUATE FACULTY

Professor W. L. Klarman, Head

Associate Professor D. M. Benson, Graduate Studies Coordinator

Professors: J. L. Apple, C. W. Averre III, K. R. Barker, D. F. Bateman, M. K. Beute, E. B. Cowling, C. B. Davey, H. E. Duncan, E. Echandi, G. V. Gooding Jr., L. F. Grand, S. F. Jenkins Jr., R. K. Jones, M. P. Levi, L. T. Lucas, C. E. Main, R. D. Milholland, N. T. Powell, P. B. Shoemaker, D. L. Strider, H. H. Triantaphyllou, N. N. Winstead; *Professors (USDA):* K. J. Leonard, R. A. Reinert, H. W. Spurr Jr.; *Adjunct Professor:* G. H. Hepting; *Professors Emeriti:* R. Aycock, C. N. Clayton, D. E. Ellis, T. T. Hebert, G. B. Lucas, L. W. Nielsen, C. J. Nusbaum, J. P. Ross, J. N. Sasser, F. L. Wellman, J. C. Wells; *Associate Professors:* R. I. Bruck, C. L. Campbell, W. M. Hagler Jr., B. C. Haning, J. S. Huang, J. W. Moyer, G. A. Payne, D. P. Schmitt, T. B. Sutton, C. G. Van Dyke; *Associate Professor (USDA):* A. S. Heagle; *Adjunct Associate Professor:* N. A. Lapp; *Assistant Professors:* J. E. Bailey, M. E. Daub, W. G. Dougherty, D. F. Ritchie, H. D. Shew; *Assistant Professors (USDA):* S. Leath, S. R. Shafer

Plant pathology has major research programs in disease management, epidemiology, mycology, molecular biology, nematology, virology, biology of soil-borne pathogens, physiology of pathogenesis and general plant pathology. Programs leading to the Master of Agriculture, Master of Life Sciences (both non-thesis), Master of Science and Doctor of Philosophy degrees are offered. Requirements for these three degrees follow University policies: 30 credit hours and thesis for the M.S. degree; 36 for the Master of Agriculture and Master of Life Sciences degrees. The latter afford students an opportunity for general education with a major emphasis in plant pathology course work and subject matter.

Courses and number of hours taken by Ph.D. candidates are determined by the student's interest and background in consultation with an advisory committee. Strong foundation courses in botanical science as well as mathematics, biochemistry, chemistry and soil science are prerequisite, however, for admission to the Ph.D. degree. Students who enroll in any graduate program should have achieved a "B" average in the undergraduate major. A diagnostic examination is utilized in placing incoming Ph.D. students in appropriate graduate courses.

Opportunities for employment include research, extension and teaching appointments at Land-Grant colleges or universities and with the U. S. Department of Agriculture. Agribusiness and biotechnology industries also employs plant pathologists in research, promotion and service. Plant pathologists often participate in overseas assignments in developing countries through international and federal organizations, as well as in commercial enterprises.

Separate laboratories fully equipped and staffed for research in molecular biology, nematology, virology, soil-borne pathogens, physiology of pathogenesis and biochemical problems are available. Microcomputers, library, mycological herbarium, photography laboratory, and an interdepartmental electron microscope center are additional features available in the department. A faculty comprised of more than 50 scientists with varied interests provide for in-depth training in all of these areas.

The department has greenhouse facilities and access to controlled environmental growth chambers in the phytotron. Student participation in the Plant Disease Clinic provides experience in the diagnosis of all types of plant diseases.

North Carolina exhibits a wide range of soil types and climatic areas. Large

acres are planted to a variety of field, vegetable and ornamental crops, as well as forest trees. Special facilities for experimental work on diseases of these crops are found at 16 permanent research stations located throughout the state.

Graduate assistantships are funded by the Agricultural Research Service, the Agricultural Foundation and other agencies. Levels of stipends are adjusted to the previous training and experience of the recipients and are competitive with those offered by other Land-Grant universities. Special supplements to stipends and fellowships are available on a competitive basis for outstanding students.

SELECTED ADVANCED UNDERGRADUATE COURSE

PP 415 Plant Disease Control. *Preq.: PP 315. 3(2-3) S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

PP 501 Phytopathology I. *Preq.: PP 315 or equivalent. 4(2-6) F.* Basic concepts of plant diseases caused by fungi and bacteria and their control will be studied. The history, classification, terminology, etiology, effect of environment on disease and variability in pathogens will be considered. Laboratory sessions will illustrate the topics mentioned above as they relate to diseases caused by fungi and bacteria. Shew

PP 502A, B, C Phytopathology II. *Preq.: PP 315 or equivalent. 6(3-6) S.* Lectures and laboratory techniques in plant pathology presented as a series of five-week minicourses: PP 502A, nematode diseases; PP 502B, virus diseases; PP 502C, epidemiology. Students may enroll for one or all of the series. Each minicourse consists of lectures on principles and laboratories involving experimental techniques fundamental to the study of nematodes and viruses as plant pathogens and analyses of plant disease epidemics.

Barker, Campbell, Moyer

PP 503 Plant Disease Diagnoses. *Preqs.: PP 501 and 502A,B,C or equivalent. 4(2-6) Sum. Alt. yrs.* Diagnoses of plant diseases in the field and laboratory, and operational aspects of a plant disease clinic will be stressed. Frequent field trips to experiment stations and private farms will provide opportunities for field observation of plant disease, plant disease research and diagnosis. Laboratory studies will emphasize identification and major sources of descriptive information of plant pathogens and abiotic agents. Grand, Jones

PP 505 Histopathology. *Preq.: PP 501 or equivalent. 2(1-3) F.* Anatomical changes that occur in diseased plant tissues will be studied. The appropriate procedures of microtechnique necessary for interpretation of pathological changes in plant tissues will be considered. Laboratory assignments will involve projects on specific diseases including photography and scientific writing. Milholland

PP 515 Epidemiology and Plant Disease Control. *Preq.: PP 315 or PP 318. 3(3-0) S.* Consideration of fundamental concepts and principles of epidemiology as they apply to modern strategies of plant disease control. Special consideration is given to evaluation of current techniques for control of fungal, bacterial, viral and nematode pathogens in an integrated crop protection system. A term paper will be required to integrate concepts and principles of disease management for a specific crop. Beute

PP (FOR) 518 Advanced Forest Pathology. *Preq.: PP 318 or equivalent. 3(3-0) F. Alt. yrs.* An in-depth study of the epidemiology and control of forest tree diseases. The nature of pathogenesis and host genetics will be related to concepts of functional diversity and disease resistance in natural ecosystems. Environmental and quantitative epidemiology, silvicultural, biological and chemical amelioration of forest tree diseases will be considered. Bruck

PP (BO, CS, ENT, PM) 525 Biological Control. 4(3-3) F. Alt. yrs. (See pest management.)

PP 550 Introduction to Research in Plant Pathology. *Preq.: CI. 1(1-0) S.* Development of the scientific method, formulation and use of hypotheses and objectives, outlining research problems, presentation of seminars, factors involved in time management and critical review of research papers in plant pathology. Payne, Shew

PP (MB, BO) 575 The Fungi. 3(3-0) F. (See botany.)

PP (MB, BO) 576 The Fungi—Lab. 1(0-3) F. (See botany.)

PP 595 Special Problems in Plant Pathology. *Preq.: CI. Credits Arranged, Maximum 6.* Investigation of special problems in plant pathology not related to a thesis problem. The investigations may consist of original research and/or literature survey. Graduate Staff

FOR GRADUATES ONLY

PP 604 Morphology and Taxonomy of Nematodes. *Preqs.: PP 502A, CI. 3(1-6) S.* Alt. yrs. A study of the morphology, anatomy and taxonomy of nematodes with emphasis on the identification of important plant-parasitic genera. Exercises include preparation of semipermanent and permanent nematode mounts. (Offered 1986 and alt. years.) Triantaphyllou

PP 605 Molecular Biology of Plant Viruses. *Preqs.: PP 502B, BCH 451 or 551. 4(2-6) S.* Alt. yrs. An in-depth study of plant viruses with emphasis on the relationship between viral structure and function. Areas covered include infection, replication, genomic expression, encapsidation and transmission. Laboratory introduces students to contemporary molecular techniques. Dougherty

PP 608 History of Phytopathology. *Preqs.: PP 315, CI. 1(1-0) F.* Alt. yrs. Development of the science of phytopathology from its early beginnings to the early part of the 20th century. (Offered 1987 and alt. years.) Campbell

PP 611 Advanced Plant Nematology. *Preqs.: PP 604 and CI. 3(2-3) F.* Alt. yrs. A study of the biology, genetics, physiology and ecology of nematodes, especially plant-parasitic forms. Primary topics include embryogenesis, post-embryonic development, gametogenesis, cytology, reproduction, sexuality, evolution, behavior, host-parasite relationships, metabolism, mechanisms of pathogenesis, interactions with other pathogens, distribution and population dynamics and impacts on crop performance. Laboratory exercises include small research projects in each area of study and demonstrations of techniques and materials. (Offered 1986 and alt. years.) Barker, Triantaphyllou

PP 612 Plant Pathogenesis. *Preqs.: PP 501, BCH 551, BO 551, CI. 3(2-3) F.* Alt. yrs. Infection processes, alterations in photosynthesis, respiration, nitrogen metabolism, vascular function and growth regulator function are considered. The biochemical nature of the weapons utilized by pathogens in pathogenic attack and the defensive mechanisms employed by the hosts in resisting attack and the resultant dynamic interactions are studied. (Offered 1987 and alt. years.) Huang

PP 614 Nematode Development, Cytology and Genetics. *Preq.: PP 604 or CI. 2(1-3) F.* Alt. yrs. A study of embryogenesis, post-embryonic development, gametogenesis, cytology, reproduction, sexuality, genetics and evolution of nematodes with emphasis on plant-parasitic forms. Laboratory exercises include small research projects in each area of study and demonstrations of techniques and materials. (Offered 1986 and alt. years.)

Triantaphyllou

PP 615 Botanical Epidemiology. *Preqs.: PP 501, 502 or CI; Coreq.: ST 511. 4(2-6) S. Alt. yrs.* Advanced study of the dynamics of plant disease epidemics in relation to agricultural crop production and forestry systems. Emphasis will be placed upon epidemiological concepts and principles, pathogen and host dynamics, disease forecasting, geographic distribution of pathogens, crop-loss assessment and the development of theoretical and practical disease-management strategies. (Offered 1987 and alt. years.) Bruck, Campbell, Main

PP (BO) 625 Advanced Mycology. *Preq.: PP 575 or CI. 4(2-6) F. Alt. yrs.* An in-depth treatment of major groups of fungi. Aspects of taxonomy, nomenclature, developmental morphology, genetics, host-parasite relations, physiology and ecology will be presented. Cardinal characteristics of selected fungi representing the major groups are determined. Field observations and collecting are also required. (Offered 1986 and alt. years.) Grand

PP 650 Colloquium in Plant Pathology. *Preq.: PP 502 or CI. 1(1-0) S.* Group discussions and individual presentations explore institutional operations in universities, research laboratories, international centers and industry. Sources of funding through appropriations, research grants and industry cooperators are examined. Criteria for evaluating the performance of professional employees, the role of scientific journals and professional societies, as well as public responsibilities are considered. Aycock, Graduate Staff

PP 690 Seminar in Plant Pathology. *Preq.: Consent of seminar chairman. 1(1-0) F,S.* Discussion of assigned phytopathological topics. Payne

PP 699 Research in Plant Pathology. *Preqs.: Grad. standing, CI. Credits Arranged.* Original research in plant pathology. Graduate Staff

Political Science and Public Administration

GRADUATE FACULTY

Professor R. O. Tilman, Acting Head

Associate Professor M. S. Soroos, Graduate Administrator for Political Science

Associate Professor E. S. Fairchild, Graduate Administrator for Public Affairs Program

Professors: G. D. Garson, A. Holtzman, D. W. Stewart, J. O. Williams; Professors Emeriti: W. J. Block, J. T. Caldwell; Associate Professors: B. A. Cigler, J. H. Gilbert, H. G. Keschull, S. H. Kessler, J. P. Mastro, J. M. McClain, E. O'Sullivan, K. S. Petersen, E. R. Rubin, J. E. Swiss, M. L. Vasu; Visiting Associate Professor: D. W. McClintock; Assistant Professors: R. H. Dorff, T. V. Reid, J. B. Rosch; Adjunct Assistant Professor: R. A. Kromer

The Department of Political Science and Public Administration offers programs leading to the Master of Public Affairs degree and the Master of Arts degree.

A candidate for admission to either program must have demonstrated an aptitude for graduate study as indicated by the Graduate Record Examination; the student may also be required to take certain undergraduate courses to make up any deficiencies that may exist in the undergraduate record.

The Master of Public Affairs degree requires completion of a 40-semester-hour professional program for persons who are now or hope to be employed by government or by a government-related private enterprise or association. An internship in a government agency, or a field paper for persons with previous public sector experience, is required.

The program requires 31 hours to be selected from courses offered by the Department of Political Science and Public Administration, including 16 hours of core courses. Students may specialize in financial management, human resource management, data management, management systems, urban management, environmental resources management or administration of justice. The remaining hours may be taken in another discipline, such as economics and business, education, industrial engineering, psychology, recreation, sociology and statistics, or as an interdisciplinary sequence of courses.

Students who enroll in the program should have completed twelve hours in the social sciences as undergraduates and have achieved a B average in the last two years of school. PA 571, a core course, has a statistics prerequisite.

The Master of Arts degree requires each candidate to complete 30 hours of graduate work including three hours in Research Methods and Analysis (PS 571). The candidate must concentrate (18-21 hours, including thesis) in two major fields of political science. Major fields are to be selected from the following: political theory, American politics, comparative politics, international relations and public administration. A disciplinary minor of 9 to 12 hours outside the Department of Political Science and Public Administration is required. A student's work in a minor field must constitute a unified pattern and must contribute to one or both of the student's major fields.

In either program the student selects a graduate committee chairperson for the preparation of a program of study which shall be subject to the approval of two other committee members, including one from outside the Department of Political Science and Public Administration.

Comprehensive written and oral examinations are required of every candidate for both degrees. In addition, a candidate for the Master of Arts degree must demonstrate reading proficiency in one modern language (normally German, French, Spanish or Russian) or a research skill and must write a thesis in one of his or her major areas.

SELECTED ADVANCED UNDERGRADUATE COURSES

PS 401 American Parties and Interest Groups. 3(3-0) F.

PS 402 Campaigns and Elections in the American Political System. *Preq.: PS 201.* 3(3-0) F,S.

PS 406 Politics and Policies of American State Governments. 3(3-0) F,S,Sum.

PS 408 Urban Politics. 3(3-0) F,S.

PS 411 Public Opinion and the Media. *Preq.: Six hours of social science.* 3(3-0) S.

PS 415 Administration of Criminal Justice. *Preq.: PS 311. Credit will not be given for both PS 415 and PA 515.* 3(3-0) F.

PS 431 International Law and Organization. *3(3-0) F.*

PS 437 National Security Policy. *Preq.: PS 331. 3(3-0) S,Sum.*

PS 446 Comparative Communist Systems. *Preq.: PS 344 or 332. 3(3-0) F,S.*

PS 447 Political Development. *Preq.: Six hours of PS. 3(3-0) F. Alt. yrs.*

PS 462 Seminar in Political Theory. *Preq.: PS 361. 3(3-0) S.*

PS 498 Special Topics in Political Science. *Preq.: Six hours of PS. 3-6 F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

PA 505 Administrative Law. *Preq.: Grad. standing or PBS status. 3(3-0) S.* Case law of the exercise of administrative power, judicial and legislative control of administrative action, legal rights of public employers and legal procedures of administrative tribunals.

McClain

PA 508 Urban Politics. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) S.* A comparative study of political conditions in cities and localities. Topics will include the formal structures and rules of city and metropolitan governments, and the relationships to the informal norms and distribution of power; patterns of local decision making; elite recruitment and citizen participation; variations of local autonomy and the scope of local politics; approaches to urban policy issues.

Ciglar

PA 509 Problems in Urban and Metropolitan Area Government. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) S.* This course examines theory and research on problems affecting governments in metropolitan areas. Principal attention is given to those problems which affect (or result from) governmental structure, institutions and politics and to the alternative approaches to their solution.

Ciglar

PA 511 Public Administration. *Preq.: Advanced undergrad. standing including 12 hours in political science, grad. standing or PBS status. 3(3-0) F,S,Sum.* A general survey of the field of public administration, examining formal and informal organizations, processes of administration, the political environment of administration and administrative responsibility and accountability.

Graduate Staff

PA 513 Financial Management in the Public Sector. *Preq.: Grad. standing or PBS status. 3(3-0) F.* This course surveys financial practices and concepts in the public sector. Topics covered include: public sector accounting, financial information systems, revenue projections, cash management and debt management. Case-based applications are emphasized.

PA 515 Administration of Criminal Justice. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. Credit for both PS 415 and PA 515 is not allowed. 3(3-0) F.* A study of politics and administration in the American criminal justice system. The interrelationships between ideology, organization and policy outputs are emphasized in the analysis of major problems confronting the system today. Topics included are: intergovernmental relations, discretionary justice, impact of judicial decisions on criminal justice administration and management trends in criminal justice bureaucracies.

Fairchild, Rosch

PA 516 Public Policy Analysis. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) F,S,Sum.* Course covers methods and techniques of analyzing, developing and evaluating public policies and programs. Emphasis is given to benefit-cost and cost-effectiveness analysis and concepts of economic efficiency, equity and distribution. Methods include problem solving, decision making and case studies. Examples are used in human resource, environmental and regulatory policy.

Swiss, Williams

PA 518 Organization Design. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) S.* An examination of contemporary approaches to organization design, including organization development, sociotechnical systems analysis and various forms of organizational participation ranging from human relations to self-management models. Issues in personnel administration are emphasized in relation to public management and government structure.

Graduate Staff

PA 519 Corrections Management. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) S.* An introduction to the theory and practice of correctional program management in the United States. Historical trends as well as contemporary issues in corrections management will be considered. Topics to be included are: leadership problems, probation and parole management, personnel, budget and program evaluation.

Fairchild

PA 520 Environmental Policy. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) F.* This course focuses on the formation and impact of environmental policy in the United States. Decision-making processes at all levels of government are examined. Comparisons are made between political, economic, social and technological policy alternatives. Emphasis is given to the application of policy analysis in environmental assessment, and theoretical perspectives on the nature of the environmental crisis are considered.

Cigler

PA (FOR) 522 Natural Resources Policy and Administration. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) S.* Overview of the problems, issues and organization of natural resources policy and administration in the United States. Emphasis on the theoretical basis for the organization of resources and environmental policies, the political and institutional basis of natural resources policy and administration and the examination of the formulation and implementation of resources policies in selected issue areas.

Graduate Staff

PA 564 Ethics and Public Policy. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) F.* The ethical dimensions of contemporary public policy issues. Consideration of selected topics such as the proper relationship between equality and social policy, the ethics of alternative economic systems and legal attempts to promote personal morality.

Kessler

PA 571 Research Methods and Analysis. *Preqs.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status and an introductory course in statistics. 4(3-1) F,S,A* focus on the behavioral approach to the study of political and administrative behavior. Topics include the philosophy of social science; experimental, quasi and non-experimental research design; data collection techniques; basic statistical analysis with computer applications.

O'Sullivan, Vasu

PA 572 Applied Research Analysis. *Preqs.: Grad. standing or PBS status and PA 571 and ST 507 or equivalent. 3(3-0) F.* An introduction to the use of advanced statistical and research tools for analysis in public administration, political science and public policy. An overview of the application of multivariate statistics and advanced research design considerations to the analysis of political data.

O'Sullivan

PA 573 Computer Applications in Public Affairs. *Preqs.: ST 507; CSC 462 or PS 371 or PA 571. 3(1-6) S, Sum.* The methodology, data analysis techniques and computer-based skills necessary to conduct and manage applied research. The course focuses on the analysis and processing of data through the medium of conventional computer software frequently used in the field, i.e., SPSS, SAS. Graduate Staff

PA 574 Data Management in Public Administration. *Preqs.: PS 374 or PA 573 and previous coursework or experience in public administration. 3(3-0) S.* An introduction to managerial applications of data management in public budgeting, public personnel and public policy analysis. Microcomputers are used to construct data bases and analytic models in these areas. Garson

PA 590 Readings and Research. *Preq.: Grad. standing. 1-3 F,S, Sum.* To enable graduate students to pursue a subject of particular interest to them by doing extensive readings or research in that subject under direct, individual faculty supervision. Graduate Staff

PA 598 Special Topics in Public Administration. *Preq.: Advanced undergrad. standing including 12 hours in political science, grad. standing or PBS status. 1-6 F,S, Sum.* Detailed investigation of contemporary topics in the fields of public administration. Topic and mode of study determined by program faculty. Graduate Staff

PS 502 The Legislative Process. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) S.* A study of the formulation of public policy from the institutional and behavioral viewpoints. Important current legislative problems at the congressional and state legislative levels will be selected and will serve as a basis for analyzing the legislative process. Holtzman

PS 506 American Constitutional Theory. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) F.* Basic constitutional doctrines, including fundamental law, judicial review, individual rights and political privileges and national and state power. Special attention is given to the application of these doctrines to the regulation of business, agriculture and labor and to the rights safeguarded by the First, Fifth and Fourteenth Amendments to the Constitution. Rubin

PS 507 Constitutional Theory II. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) F,S.* A continuation of PS 506, but may be elected separately. An examination of leading constitutional cases, especially in the fields of civil liberties and individual rights and the writings of leading commentators. Reid, Rubin

PS 512 Comparative Administration. *Preq.: PA 511 or PS 346 or CI. 3(3-0) F,S.* Concentration will be on administrative systems of developing nations with limited attention to developed systems. The major emphasis will be on administrative aspects of governmental change and modernization in developing nations; colonial influence on administration; problems of establishing new nations and adapting to change in established states; bureaucratic development and behavior; theories of development administration. Graduate Staff

PS 514 Public Finance. *Preq.: EB 205. 3(3-0) F.* A survey of the theories and practices of governmental taxing, spending and borrowing, including intergovernmental relationships and administrative practices and problems. Graduate Staff

PS (SOC) 517 The Police Bureaucracy in a Democratic Society. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) S.* This is a political science seminar which focuses on the proposition that police departments are bureaucratic organizations which can be studied as such. Emphasis is placed on

understanding the process by which police policy is made. Internal and external, psychological and structural variables are identified in tracing decisions on specific issues. Thus, attitudes of policemen, the nature of their work and the resources and power of various constituencies are factors seen as determining police behavior. Fairchild, Rosch

PS 533 Global Problems and Policy. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. Credit for both PS 433 and PS 533 is not allowed. 3(3-0) F.* International policy processes and policy responses to problems of global scope including the role of international law. Consideration given to economic development, human rights and other policy problems selected for specific semesters. Independent research on a global policy problem of student's choice. Soroos

PS 541 Military Coups and Regimes in the Third World. *Preqs.: Advanced undergrad. standing, grad. standing or PBS status. 3(3-0) F.* The seizure and exercise of political power by military forces in Asia, Africa and Latin America. Causes and techniques of military coups, with emphasis on the social, economic and political policies of military regimes. Case studies within the context of theories about the political role of the military. Graduate Staff

PS 542 Western European Politics. *Preq.: Nine hrs. of political science, grad. standing or PBS status. Credit in both PS 442 and PS 542 is not allowed. 3(3-0) F.* Analysis of political institutions and processes in selected Western European states and the European community and of major social, economic and political issues confronting European societies. Graduate Staff

PS 561 Ancient Political Theory. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) F.* A study of selected classics in the tradition of ancient political theory. Authors to be read include Plato, Aristotle, Aristophanes, Xenophon and Cicero. Kessler

PS 562 Modern Political Theory. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) S.* A study of selected classics in the tradition of modern political theory. Authors to be read include Machiavelli, Hobbes, Locke, Montesquieu, Rousseau, Marks and Nietzsche. Kessler

PS 563 Power and Ideology. *Preq.: Advanced undergrad. or grad. standing. 3(3-0) F.* This course will explore competing theories of power and its distribution in the United States and of the nature of ideology. It will analyze various forms of elite theory, particularly pluralist theory and its critics and of empirical democratic theory, with specific reference to the concepts of power and ideology. Primary attention will be given to the case of the United States, with projections made regarding the nature of power and ideology and the prospects for democracy in post-industrial societies. Graduate Staff

PS 569 Topics in Political Theory. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. (Maximum of 6 hours may be taken). 3(3-0) F,S.* A close examination of particular topics or theories that are not included in the basic courses in political theory. Course content changes in different years, and, with permission of instructor, the course may be repeated for credit. Examples of course topics are: "Foundations of Modern Radicalism," "Twentieth Century Political Philosophy and Political Science," "Political Philosophy and the Problem of Law" and "Origins of Political Science." Kessler

PS 571 Research Methods and Analysis. *Preqs.: Advanced undergrad. standing including 12 hrs. of PS, grad. standing or PBS status. 3(3-0) F,S.* A survey of methods used in behavioral research as applied to the field of political science: elements of empirical theory, research design, measurement of variables, sampling procedures, data courses, techniques of data collection, statistical analysis, qualitative methodologies and the presentation of research findings. Graduate Staff

PS 590 Readings and Research. *Preq.: Grad. standing or PBS status. 1-3 F,S,Sum.* Graduate students pursue a subject of particular interest to them by doing extensive readings or research in that subject under direct, individual faculty supervision.

Graduate Staff

PS 598 Special Topics in Political Science. *Preq.: 6 hours of political science. 1-6 F,S.* Detailed investigation of a topic. Topic and mode of study determined by the student and a faculty member.

Graduate Staff

FOR GRADUATES ONLY

PA 608 Seminar in Urban Management. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) F,A* seminar focusing on the analytical techniques and managerial principles required for policy formation and implementation in a complex urban governmental environment. Specific topics include: urban planning and community development, housing, intergovernmental relations, organizational roles and decision making, budgeting and selected urban services (for example: police, transportation).

Cigler

PA 611 Seminar in Public Personnel Management. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) F,S.* Examines the major issues in public sector personnel management. Among topics considered are: staffing, position classification, compensation, affirmative action, performance review and appraisal, patronage, training, career development, employee assistance, unionization and rights of public employees.

Graduate Staff

PA 612 The Budgetary Process. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) F,S,Sum.* This course examines generalized budgetary process used at all levels of government in the United States. Understanding of the process is based upon comprehension of the institutions involved, the roles of politicians and professionals and the objectives of budgetary systems. The course also focuses upon budgetary reforms and on Planning-Programming-Budgetary and Zero-Based Budgeting as management tools.

Coe, McClain

PA 613 Government and Planning. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) F,Sum.* A study of the planning function at all levels of government in the United States, with particular attention to the problems posed for planning by the rapid growth of metropolitan areas. An overview of community development, urban spatial structure, housing economics and land use planning.

Vasu

PA 614 Management Systems. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) S,Sum.* An examination, through case studies and applied methodology, of various management systems and management techniques. Among the topics considered are: differences between market and nonmarket organizations, financial management systems, quantitative decision-making approaches, planning techniques such as CPM and PERT, MBO and productivity systems.

O'Sullivan, Swiss

PA 615 Seminar in Administrative Problems. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hour of 500-level course work. 2-4. S,Sum.* An advanced course in administrative principles and methods. Students will perform individual or group research under supervision in specific administrative topics within the context of those public agencies which function in their respective fields of technology.

Block, McClain

PA 616 Seminar in Program Evaluation. *Preqs.: Grad. standing or Management Development Certificate Program and a grad. course in research methods. 3(3-0) F,S.* The course combines seminar and field research techniques to study the evaluation of public programs. Focus on political and administrative problems associated with program evaluation. The availability and appropriateness of various quantitative methodologies are also examined. Seminar concepts are applied through evaluative projects conducted for public agencies. O'Sullivan

PA 617 Seminar in Organization Theory. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) F,S.* The seminar examines major conceptual frameworks developed to understand organizational behavior. Topics stressed include motivation, leadership, group dynamics, communication, socio-technical systems, work design and organizational learning. The emphasis is on applying theories and concepts to public sector organizations. Stewart

PA 618 Seminar in Policy and Administration. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) F.* A seminar in theories and techniques of administration in applied situations, using case study techniques. Block

PA 619 Intergovernmental Relations in the United States. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) S.* The course examines distinctive features of intergovernmental relations in the United States. Topics stressed include historical adaptations of federalism, the emerging role of the administrator, contemporary trends in intergovernmental relations and assessment of contemporary trends from federal, state and local perspectives. Coe

PA (FOR) 620 Environmental Administration. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) S.* A review and investigation of the major environmental management systems utilized to plan, develop and implement environmental programs. Graduate Staff

PA 621 Collective Negotiations in the Public Service. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) Sum.* This course includes intensive consideration of the background of the collective negotiations movement; analysis of key policy issues, such as bargaining rights and the use of strike weapons; framework for collective negotiations; scope and conduct of negotiations; impasse resolution; grievance procedure. Graduate Staff

PA 691 Internship in Public Affairs. *Preq.: Minimum 9 hrs. graduate work. 1-6 F,S,Sum.* This course exposes the student to the environment and value systems of the public organization through a supervised work experience. It involves the application of substantive knowledge and analytical skills to organizational problems. Credit will vary with the nature of the work experience. O'Sullivan

PS 601 Seminar in Party and Group Politics. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) S.* This course examines in depth such problems as mobilization of consent, recruitment of leaders, financing and conduct of campaigns, nomination processes, interparty and intraparty politics, party-interest group relations and ideology and party-interest group relations with government and public policy. Short research papers will be required, some of which will be presented and evaluated in class. Holtzman

PS 602 Seminar in Legislative Problems. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) S.* This seminar considers basic problems characteristic of American legislative systems: development and maintenance for formal and informal rules of the game; relationships between outside inputs (by parties, interest groups, constituents, executives, courts) and legislators; strategies and tactics of leadership; committee decision making, roles and role behavior of legislators; bicameral and apportionment problems. Each student is required to do extensive reading, to interview legislators and those who seek to influence them and to prepare reports.
Holtzman

PS 604 The Chief Executive. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) S,Sum.* This course will focus upon three major concepts of the office of the chief executive as developed under several incumbents. First are the institutions which surround that office and which facilitate the expansion of its power and operations. Next are the various roles which are played by different chief executives. Last are the processes of leadership by which the chief executive can attempt to direct the machinery of government to achieve predetermined objectives.
Holtzman

PS (ED) 607 The Politics of Higher Education. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0).* An examination of the differing and changing perceptions of the role of higher education in American society; the politics of competition for priority of attention and resources; organizational alternatives in its control; relevant elements in the structure and processes of government. References to other societies.
Graduate Staff

PS 631 Seminar in International Relations. *Preq.: Six semester hours of 500-level course work. 3(3-0) F,S,Sum. May be taken for up to six hours credit.* An in-depth examination of a topic within the larger field of international politics to be selected by the instructor for each semester from subjects pertaining to interstate relations, international law and organization, regional politics, foreign and security policy or global issues. Students will undertake a substantial independent research project.
Graduate Staff

PS 641 Seminar in Comparative Politics. *Preqs.: One course in comparative politics and one course in political science methodology or CI. 3(3-0) F,S.* This seminar will open with a survey of the problems and methods of comparative political analysis, after which students will be assigned a specific, limited subject to be examined within the framework of a systematic, analytical scheme appropriate to the topic. Specific topics will be drawn from the subjects of political ideologies, political groups, political elites and decision-making institutions and processes.
Graduate Staff

PS 691 Internship in Political Science. *Preq.: Grad. standing. 1-6 F,S,Sum.* This course exposes the student to the environmental and value systems of public organizations through a supervised work experience.
Graduate Staff

PS 696 Seminar in Politics. *Preq.: Advanced grad. standing. 2-4 F,S.* An independent advanced research course in selected problems of government and politics. The problems will be chosen in accordance with the needs and desires of the students registered for the course.
Graduate Staff

PS 699 Research in Politics. *Preqs.: Grad. standing and approval of adviser. Credits Arranged. F,S.* Research for writing the master's thesis.
Graduate Staff

Poultry Science

GRADUATE FACULTY

Professor Head

Professors: T. A. Carter, R. E. Cook, W. E. Donaldson, F. W. Edens, J. D. Garlich, E. W. Glazener, P. B. Hamilton, C. H. Hill, C. R. Parkhurst, J. P. Thaxton, J. B. Ward; *Extension Professor:* J. R. Harris; *Associate Professors:* J. T. Brake, V. L. Christensen, W. M. Hagler Jr., F. T. Jones, J. F. Ort, J. C. H. Shih, T. D. Siopes; *Adjunct Associate Professors:* N. Chernoff, D. I. McRee; *Assistant Professor:* R. M. Shuman; *Adjunct Assistant Professor:* M. J. Galvin Jr.; *Researcher:* R. P. Gildersleeve

ASSOCIATE MEMBERS OF THE DEPARTMENT

Professors: H. R. Ball Jr., D. G. Simmons; *Assistant Professor:* B. W. Sheldon

The Department of Poultry Science offers the Master of Science degree. Doctoral programs are offered in the disciplines of microbiology, physiology, genetics and nutrition.

The department occupies Scott Hall, containing well-equipped laboratories, animal rooms and offices. Additional research facilities are located on the University farms and the Piedmont Research Station.

The Dearstyne Avian Research Center, a three-building complex, is used in connection with special research projects related to disease resistance and treatment of various pathological conditions. The complex is made up of animal isolation rooms, biochemical laboratories and related facilities.

The research program is comprehensive and includes fundamental studies in genetics, microbiology, nutrition, pathology and physiology. In addition, investigation of problems of more practical urgency is undertaken when appropriate.

The demand for men and women with advanced training in poultry science is far greater than the supply. Opportunities exist for graduates in research and teaching in universities, in government and in private industry.

SELECTED ADVANCED UNDERGRADUATE COURSES

PO 405 Avian Physiology. *Preq.: CH 220. 4(3-3) F.*

PO 410 Production and Management of Game Birds in Confinement. *Preq.: PO 201. 3(2-3) S.*

PO (ANS, NTR) 415 Comparative Nutrition. *Preqs.: CH 220 or both 221 and 223. 3(3-0) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

PO 505 Physiological Aspects of Poultry Management. *Preqs.: PO 201, PO 405 or grad. standing. 3(3-0) S.* Application of physiological principles to modern poultry management. Poultry physiology related to management topics including nutrition, housing, ventilation, disease, heat stress and lighting programs.

Graduate Staff

PO (GN) 520 Poultry Breeding. *Preq.: GN 411. 3(2-2) S.* Application of genetic principles to poultry breeding, considering physical traits and physiological characteristics.

Graduate Staff

PO (ZO) 524 Comparative Endocrinology. *Preq.: ZO 421 or equivalent. 4(3-3) S.* Basic concepts of endocrinology, including functions of major endocrine glands involved in processes of growth, metabolism and reproduction.

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FOR GRADUATES ONLY

PO (ANS, NTR) 605 Mineral Metabolism. *3(3-0) F.* (See animal science.)

PO 698 Special Problems in Poultry Science. *Preq.: Grad. standing. Maximum 6 F,S.* Specific problems of study are assigned in various phases of poultry science.

Graduate Staff

PO 699 Poultry Research. *Preq.: Grad. standing. Credits Arranged. A maximum of six credits is allowed towards a master's degree. F,S.* Appraisal of present research; critical study of some particular problem involving original investigation. Problems in poultry breeding, disease, endocrinology, hematology, microbiology, nutrition or physiology.

Graduate Staff

Product Design

GRADUATE FACULTY

Professor V. M. Foote, Program Director

Professors: A. S. Lowrey, C. E. McKinney; Professors Emeriti: G. L. Bireline Jr., J. H. Cox; Associate Professors: A. V. Cooke, R. A. Donaldson, C. E. Joyner, G. N. Prygrocki, J. M. Wittkamp; Assistant Professors: M. S. Lange, P. L. Middleton, S. D. Wilchins

The Department of Product Design offers courses of study leading to a Master of Product Design degree with three distinct concentrations: product design, visual design and fabric design.

Product design deals with all aspects of machine-made products and their relationship to people and the environment. The discipline therefore involves three major design and research activities: human behavior, the human/product relationship and the product itself. In the School of Design's Product Design curriculum, the emphasis is on the product designer's responsibility in enhancing the quality of human life. Students learn to consider the effect of a product from conception through production to eventual end use.

The graduate curriculum prepares students for professional careers in product research, development and design. Core and elective courses focus on problem identification, problem-solving methods, communication skills and the nature of materials and production processes.

In the studio, students use this knowledge to solve real design problems requiring research, creativity and the application of newly acquired technical skills. Working on these projects helps students consider essential design factors such as form, safety, physiology, manufacturing processes, color, texture, cost and maintenance.

Graduates of the Product Design Department are working in a variety of fields, including furniture, housewares, appliances, transportation, machine tools, medical and electrical instruments and microelectronics. In addition, the department offers many opportunities for 'co-op' educational programs, which combine academic coursework with valuable on-the-job experience.

Students in the visual design curriculum learn to graphically communicate information, concepts and feelings through various media, especially print. Classes in graphic design history, typography, photography, illustration, printing processes and materials are synthesized with theory and methodology in the studio.

The graduate curriculum prepares students to apply creativity and technical expertise in either professional or non-applied academic research. Professional situations include study of signs and symbols, posters, book and magazine design, packaging, exhibits, advertising and computer graphics. The academic orientation of study involves investigations of communication theory, problem-solving methodologies, form generating strategies, visual perception and design evaluation.

Fabric design is the conception and creation, by hand or machine, of fiber and fiber objects. While fabric yardage immediately comes to mind, textile designers also create clothing and accessories, home furnishings, wall hangings and other textiles for specific architectural or environmental purposes.

In all these areas, the textile designer must combine creative ability and technical skill to conceive a product that is aesthetically pleasing, functionally sound and appropriate for production. This requires a thorough understanding of the production process, including product research, development and design; basic management principles and structures; and marketing, manufacturing and merchandising. Students pursue study in specific areas of textile design, including printing, weaving, knitting, design and production processes. Whether the interest is in industrial mass production or craftsmanship in traditional methods of fabric construction, the same emphasis is placed on high quality textile design and how it shapes, alters and enhances the human environment.

In the graduate program, students earn the professional Master of Product Design, with a fabric design concentration.

The student's program of selected course work and terminal project are under the direction of his or her graduate advisory committee. The terminal project shall constitute the final test of the candidate's mastery of his or her design studies. The project shall be developed in the design studio or special projects framework in the final year and shall consist of an in-depth investigation of an approved problem which relates product design studies to the student's minor field. All students with a five-year undergraduate degree or equivalent or professional experience shall be required to complete a minimum of 30 hours of course work of which approximately 70 percent will be in the major field and the remainder elected from various specialized areas.

For students holding four-year undergraduate degrees in design, the program requires a minimum of 48 credit hours of course offerings in the normal two-year master's work.

Applications for this program may come from the following sources: graduates of approved schools of product design, graduates of approved programs of in-

dustrial design, graduates of approved schools of visual design, graduates of accredited schools of architecture or landscape architecture, graduates of approved schools of art and design, graduates of accredited schools of engineering and, under special circumstances, students with degrees in fields other than design. In those latter instances an advisory committee will evaluate the applicant's preparation with regard to design capabilities and professional competence. In addition, course offerings are available to any graduate student who can demonstrate reasonable competence or equivalent qualifications for prerequisites in the requested courses. All applicants in addition to meeting the qualifications of the Graduate School must meet the special requirements of the product design program with regard to design capabilities and professional competence.

SELECTED ADVANCED UNDERGRADUATE COURSES

PD 400 Intermediate Product Design (Series). *Preq.: DF 102. 6(0-9) F,S.*

PD (TX) 471 Textile Design I. *Preqs.: PD (TX) 271, PD (TX) 272. 3(2-2) S.*

PD (TX) 472 Textile Design II/Internship. *Preq.: PD (TX) 471. 3 Sum.*

PD (TX) 473 Textile Design III. *Preqs.: PD (TX) 473. 3(2-2) F.*

PVD 400 Intermediate Visual Design (Series). *Preq.: DF 102. 6(0-9) F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

PD 511 Product Design Materials and Processes I. *Preq.: Grad. standing. 3(3-0) F.* An analysis of paper, wood, metal and manufacturing processes utilized in the production of mass-produced products. Advanced studies in mass production processes and their influence on design and development of products. Emphasis is placed on material search and process selection in relation to product safety, cost, function, human factors, form, finishes and joining methods.

PD 512 Product Design Materials and Processes II. *Preq.: Grad. standing. 3(3-0) S.* An analysis of plastics and rubber and the related manufacturing processes utilized in the production of mass-produced products. Advanced studies in mass production processes and their influence on design and development of products. Emphasis is placed on material search and process selection in relation to cost, product safety, function, human factors, form, finishes and joining methods.

PD 517 Advanced Typographic Systems. *Preqs.: DN 217 and DN 317. 3(1-3) F.* Systematic approaches to structuring topographic form according to information hierarchies, user needs and visual expression. Application to the organization of tables, charts, books, magazines, corporate identities and signage.

PD 518 Advanced Typographic Expression. *Preqs.: DN 217 and DN 317 or equivalent. 3(2-2) S.* This course will focus on experimentation in typography for the purpose of subjective expression. Analysis of historical precedent, contemporary usage and the semiotics of shaped writing will provide a basis for the advanced student to study and use typography as image, metaphor and symbol.

PD 541, 542 Advanced Visual Design I, II. *Preqs.: ARC 400, LAR 400, PD 400 or PVD 400; waiver of prerequisite is at the discretion of the instructor. 6(3-9) F,S.* Application of previous studies in design and visual communications to a wide variety of visual problems presented by our physical environment.

PD 591 Special Seminar in Product Design. *Preq.: Grad. standing. 1-3 F,S.* Seminars on subjects of current interest in product design which are presented by persons not part of the regular faculty.

PD 592 Special Topics in Product Design. *Preq.: Grad. standing. 2-3 F,S.* Topics of current interest to the program/option offered by faculty in the School. Subjects offered under this number are normally used to test and develop new courses.

PD 595 Independent Study in Product Design. *Preq.: Grad. standing. Max. 6 F,S,Sum.* Special problems in various aspects of product design developed under the direction of a faculty member on a tutorial basis.

FOR GRADUATES ONLY

PD 600 Advanced Product Design (Series). *Preq.: Portfolio review.* Advanced studies in product design. Special emphasis is given to problem identification, program formulation and application of advanced design methods. All problems will be of an individual nature leading to a synthesis of previous design experience.

PD 631, 632 Advanced Concepts in Product Engineering. *Preqs.: PD 600, grad. standing. 3(3-0) F,S.* Group investigation of advanced concepts in product design with emphasis on engineering. Engineering principles play an important role in the design of useful products. The scope of this course will include mass movement of persons as well as the designs of consumer products. The field of transportation and consumer products are fast changing to satisfy the needs of the present and future generations. The product designer is to be made aware of these needs by special investigations into future technologies and future material developments.

PD 690, 691 Special Topics in Product Design. *Preq.: Grad. standing. 1-6 F,S.* An investigation of special topics in product design of a particular interest to advanced students under the direction of the chair of the graduate committee on a tutorial basis. Credit and content will vary with each student.

Psychology

GRADUATE FACULTY

Professor P. W. Thayer, Head

Professors: J. W. Cunningham, D. W. Drewes, T. E. LeVere, S. E. Newmar, B. W. Westbrook; *Professors Emeriti:* K. L. Barkley, H. M. Corter, J. C. Johnson, H. G. Miller; *Associate Professors:* J. L. Cole, J. W. Kalat, K. W. Klein, J. E. R. Luginbuhl, D. H. Mershon, F. J. Smith, S. S. Snyder, N. W. Walker; *Adjunct Associate Professors:* B. F. Corder, J. L. Howard; *Associate Professors Emeriti:* J. W. Magill, M. H. Pitts, R. F. Rawls; *Assistant Professors:* W. P. Erchul, D. Gray, T. M. Hess, P. E. Horan, S. B. Pond III, D. Scott-Jones; *Visiting Assistant Professor:* B. A. Braddy; *Adjunct Assistant Professors:* M. A. Campion, A. D. Hall, C. L. Kronberg, L. A. Makoid

ASSOCIATE MEMBERS OF THE DEPARTMENT

Professors: R. G. Pearson, J. L. Wasik; *Associate Professor:* C. D. Korte

The Department of Psychology offers courses of study leading to the Master of Science and Doctor of Philosophy degrees. Specialization in applied developmental psychology, experimental psychology, ergonomics, industrial-organizational and vocational psychology, social psychology and human resource development is available.

A minimum of 30 semester hours of graduate credit is required for the master's degree. Though no minimum number of additional hours is required for the doctoral degree, the student may expect to take 30 or more additional semester hours of graduate credit. The actual graduate program for each master's and doctoral student is tailored to the needs, interests and accomplishments of the individual. Admission requirements for the beginning graduate student in psychology are satisfactory grades in all undergraduate work and at least a "B" average in undergraduate psychology courses and in the undergraduate major, satisfactory scores on the Graduate Record Examination including the Advanced Test in psychology and the Miller Analogies Test and three satisfactory letters of recommendation in regard to quality of work and character. It is possible to enter the program without undergraduate coursework in psychology but some preparation in experimental psychology, statistics and mathematics is desirable.

Admission requirements for students already possessing the master's degree who wish to obtain the doctorate in psychology are a minimum of a "B" average in their graduate work and a substantial background in psychology or related fields, satisfactory grades in undergraduate studies, satisfactory scores on the Miller Analogies Test and the Graduate Record Examination including the Advanced Test in psychology (if the applicant's master's degree is in a field other than psychology, the Advanced Test score in that field should also be submitted) and three satisfactory letters of recommendation in regard to quality of work and character. Beginning and advanced students must be sponsored by a faculty member of this department to be admitted.

A limited number of research and teaching assistantships and fellowships are available to qualified graduate students.

SELECTED ADVANCED UNDERGRADUATE COURSES

PSY 476 Psychology of Adolescent Development. *Preq.: Jr. standing. 3(3-0) F,S.*

PSY 491 Special Topics in Psychology. *Preq.: PSY 200. 3(3-0) F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

PSY 500 Visual Perception. *Preq.: Grad. standing or CI. 3(2-2) F.* Detailed consideration of anatomy and physiology of the visual system (both peripheral and central components). Modern quantitative approaches to psychophysical problems of detection, discrimination scaling. Examination of chief determinants determiners of visual perception, including both stimulus variables and such organismic variables as learning, motivation and attention. Discussion of perceptual theory and processes emphasizes several topics in two- and three-dimensional spatial perception.

Mershon

PSY 501 Introduction to Graduate Study in Psychology. *Preq.: Grad. standing in PSY. 1(1-0) F.* Orientation to graduate study in psychology. Library and computer systems. Faculty research and teaching interests. Special research facilities and populations. Standards for research with human and infrahuman subjects. Ethical principles of American Psychological Association. Generic and specialty guidelines for providers of psychological services. North Carolina Licensing Law and supporting rules. Psychology as science, discipline and profession. Newman

PSY 502 Physiological Psychology. *Preq.: Twelve hours of PSY including PSY 200, 300, 310. 3(3-0) F.* First of two-semester sequence concerned with the physiological foundations of behavior. The emphasis in this first course is basic vertebrate neuroanatomy and neurophysiology. LeVere

PSY 503 Comparative Psychology. *Preq.: 9 hours in PSY or animal behavior or CI. 3(3-0) S.* A study of animal behavior, species differences in behavior and biological determinants of behavior. An emphasis on the careers and research styles of some eminent comparative psychologists, for example, Richter, Tinbergen, Harlow, Stein and Rensch. Kalat

PSY 504 Advanced Educational Psychology. *Preq.: Six hours of PSY. 3(3-0) F.* A critical appraisal of current psychological findings that are relevant to educational practice and theory. Baker-Ward

PSY 505 History and Systems of Psychology. *Preqs.: PSY 200, 300, 310, 320 or CI or grad. status. 3(3-0) S.* The aim of this course is to acquaint students with the history of psychology and psychological systems and to give students some practice in taking different approaches to a particular problem area. Cole

PSY 510 Learning and Motivation. *Preq.: Grad. standing or PBS status. 3(3-0) S.* A systematic analysis of some of the major classes of variables determining behavioral change. Learning variables are analyzed within their primary experimental setting, and emphasis is upon the diversity of the functions governing behavior change rather than upon the development of some comprehensive theory. Both learning and motivational variables are examined as they contribute to changes in performance within the experimental setting. Cole

PSY 511 Advanced Social Psychology. *Preq.: Grad. standing or PBS status. 3(3-0) F.* A survey of theory and research in social psychology through reading and discussion of primary source materials. In addition, the course will deal with issues of methodology, ethical questions in social psychological research and application of research findings to the world at large. Klein, Luginbuhl, Smith

PSY 514 Foundations of Behavioral Research. *Preqs.: Grad. standing, ST 507 and PSY 535 or equivalent. 3(3-0) F.* A course in scientific behavioral research, basically psychological in nature, designed to help students understand the fundamental nature of the scientific approach to problem solution. Technical and methodological problems are considered. The course emphasizes the controlled and objective study of the relations among phenomena, the scientific approach and the relations between a research problem and the design and methodology of its solution. Westbrook

PSY 520 Cognitive Processes. *Preq.: Grad. standing or PBS status. 3(2-2) F.* This course will emphasize the results from research on a number of complex processes (e.g., remembering, concept learning, problem solving, acquisition and use of language) and the theories that have been proposed to explain these results. Newman

PSY 530 Advanced Abnormal Psychology. *Preqs.: PSY 200, 370. 3(3-0) S.* The causes, symptomatic behavior and treatment of the major personality disturbances. Emphasis on theory, experimental psychopathology and preventive measures. Graduate Staff

PSY (ED) 531 Mental Retardation. *3(3-0) F, Sum.* (See education.)

PSY 532 Psychological Aspects of Exceptionality. *Preq.: CI. 3(3-0) S, Sum.* The course is designed to give consideration to effects of severe deficiency (sensory, physical, mental, etc.) arising from any causes at any stage of life; the personal and social ramifications of these; and possible courses of intervention; as well as utilization of psychological theory and clinical information in interpreting probable implications. Research findings related to sensory deprivation, research needs and possible research projects will be discussed.

Graduate Staff

PSY 533 Biological Factors in Abnormal Behavior. *Preqs.: 6 hours of PSY and 6 hours of biology. 3(3-0) Sum. Alt. yrs.* Biological influences and predispositions in abnormal human behavior, including brain damage and disconnection syndromes, psychosomatic illnesses, anxiety and neurosis, manic-depressive disorder, schizophrenia and disorders of memory, eating, movement, sexual behavior and others. Assumes only a moderate biology background.

Kalat

PSY 535 Tests and Measurements. *Preq.: Six hours of PSY. 3(3-0) F, S.* A study of the principles of psychological testing including norms and units of measurement, elementary statistical concepts, reliability and validity. In addition, some attention is devoted to the major types of available tests such as general intellectual development, tests of separate abilities, achievement tests, measures of personality and interest inventories.

Westbrook

PSY (IE) 540 Human Factors in Systems Design. *Preq.: IE (PSY) 338 or IE 354; Coreq.: ST 507 or 515. 3(3-0) F.* Introduction to problems of the systems development cycle, including man-machine function allocation, military specifications, display-control compatibility, the personnel sub-system concept and maintainability design. Detailed treatment is given to man as an information processing mechanism.

Pearson

PSY 545 Fundamentals of Skill. *Preq.: Grad. standing or PBS status. 3(3-0) F. Alt. yrs.* Fundamentals of human perceptual, cognitive and sensory-motor abilities that are basic to skilled performance. Treatment of such topics as channel capacity, short-term memory, stress, fatigue, arousal theory, task taxonomy, skill acquisition, proficiency decrement, information feedback and performance analysis. Problems of attention, search, monitoring, tracking, complex tasks and skill maintenance.

Graduate Staff

PSY (ED) 553 Community Service Agencies. *3(3-0) F, S.* (See education.)

PSY 560 Personnel Selection Research. *Preqs.: Six hrs. of grad. statistics, PSY 535. 3(3-0) F. Alt. yrs.* A survey of theoretical, methodological and research literature on personnel selection. Topics include organization, task and person analyses, validation strategies, utility and equal opportunity issues and selection strategies. Emphasis is on research.

Thayer

PSY 561 Training Research. *Preqs.: Six hours of grad. PSY and six hours of grad. ST. 3(3-0) F. Alt. yrs.* A survey of conceptual and research literature on training. Topics include needs assessments, learning, transfer, maintenance, criterion and evaluation issues, as well as a review of research on specific training techniques. Emphasis is on research methods and findings, not skill development in specific training techniques.

Thayer

PSY 565 Organizational Psychology. *Preq.: Nine hours of PSY. 3(3-0) F.* A study of the application of behavioral science, particularly psychology and social psychology, to organizational and management problems.

Pond

PSY 566 Organization Development and Change. *Preq.: PSY 565. 3(3-0) S.* A survey of theory and research in organization development. Attention will be directed to: (1) methods of diagnosing the need for organizational change, (2) techniques currently used to implement and evaluate organizational change, (3) professional ethics and other issues dealing with the client-consultant relationship. Emphasis will be on developmental approaches originating from psychology and allied fields. Pond

PSY 570 Theories of Personality. *Preq.: Grad. standing. 3(3-0) F.* A review of theories of personality, with emphasis on research, application in psychotherapy and measurement, principles involved in similarities and differences among them and development of a personal model. Horan

PSY 571 Individual Intelligence Measurement. *Preq.: PSY 535 and consent of school psychology coordinator. 3(3-0) S.* A practicum in individual intelligence testing with emphasis on the Wechsler Bellevue, Stanford-Binet, report writing and case studies. Walker

PSY 572 Psychological Survey Operations. *Preq.: ST 507 or equivalent; Coreq.: ST 508 or equivalent. 3(3-0) S.* Emphasis is on application of survey operational methods to problems of interest to psychologists in governmental, institutional and industrial settings. Course is designed to provide competency in questionnaire construction, data collection, design and analysis procedures and report writing. The class will design, conduct and analyze a survey on topic of their own selection in the area of psychology. Klein

PSY 575 Behavior Modification. *Preq.: Grad. standing or PBS status. 3(2-2) S.* The course will deal with the application of behavior modification techniques. Balanced emphasis will be placed upon theoretical foundations, ethical considerations, acquisition of skills and practicum experiences. Specifically, course content will consist of methods of applying laws derived from the psychology learning laboratory such as reinforcement schedules, contingency specifications and objective behavioral analyses to the solution of behavioral problems in practical situations. Enrollment limited to 12 students; priority (1) school psychology, (2) other psychology graduate students. Graduate Staff

PSY 576 Developmental Psychology. *Preq.: Nine hours of PSY, including PSY 376, PSY 475 or PSY 476. 3(3-0) F.* A survey of the role of growth and development in human behavior, particularly during the child and adolescent periods. This course will pay particular attention to basic principles and theories in the area of developmental psychology. Scott-Jones, Snyder

PSY 577 Adolescent Development. *Preq.: 6 hours in PSY or CI. 3(3-0) S, Sum. Alt. yrs.* Current theories and research on development during adolescence. Topics include: physical growth, cognitive changes, relationships with peers, parents and teachers, quest for identity and independence, morality and sexuality. Snyder

PSY 578 Individual Differences. *Preq.: Six hours of PSY. 3(3-0) S. Alt. yrs.* The objective and quantitative investigation of individual differences in behavior. The course deals with the following questions: What is the nature and extent of individual differences? What can be discovered about their causes? How are the differences affected by training, growth and physical conditions? In what manner are the differences in various traits related to one another or organized? Westbrook

PSY 579 Adult Development and Aging. *Preq.: PSY 576 or equivalent. 3(3-0) S. Alt. yrs.* Critical examination of theory and research associated with the study of normal adult development and aging. Topics include: methodological issues; cognitive and intellectual development; changes in learning and memory; personality and emotional development; socialization processes; psychophysiological and biological factors. Hess

PSY 580 Psychological Consultation. *Preq.: Nine hrs. grad. PSY or ED. 3(2-2) S.* Introduction to psychological consultation with emphasis on school setting. Presentation of various consultation models and theoretical bases. Development of skills in practice of consultation. Erchul

PSY 591 Special Topics in Psychology. *Preq.: 6 hours of PSY; Coreq.: 3 hours of ST. 1-3 F,S.* Course will provide opportunity for exploration in depth of advanced areas and topics of current interest. Graduate Staff

PSY 592 Area Seminar in Experimental Psychology. *Preq.: Grad. standing or PBS status. 1-3, Max. 6. F,S.* The following topics will be dealt with: (1) the development of experimental psychology as an area of inquiry, (2) methods of inquiry, (3) contemporary issues, (4) ethical questions, (5) relationship to other areas within psychology. Graduate Staff

PSY (IE) 593 Area Seminar in Ergonomics. *Preq.: Grad. standing or PBS status. 1(0-2), Max. 3. F.* Introduction to ergonomics as an area of study; historical aspects; contemporary issues; ethical questions; overview of campus research, facilities and courses in the area; consideration of information sources, financial support for research proposals and employment opportunities. Pearson

PSY 594 Area Seminar in Human Resources Development. *Preq.: CI. 1-3, Max. 6. F,S.* The following topics will be dealt with: (1) human resources development as an area of inquiry, (2) methods of inquiry, (3) contemporary issues, (4) ethical questions, (5) relationship to other areas within psychology. Drewes

PSY 595 Area Seminar in School Psychology. *Preq.: Grad. standing or PBS status. 1-3, Max. 6. F,S.* The following topics will be dealt with: (1) the development of school psychology as a professional area, (2) methods of inquiry, (3) scientific and theoretical bases, (4) contemporary issues, (5) ethical questions, (6) relationship to other areas within psychology. Graduate Staff

PSY 596 Area Seminar in Social Psychology. *Preq.: Grad. standing. 1-3, Max. 6. F,S.* This course will deal with the following topics: (1) a survey of areas within social psychology, (2) methods of inquiry, (3) contemporary issues, (4) ethical questions, (5) the relation of social psychology to other branches of psychology, to other disciplines and to society and its problems. Graduate Staff

PSY 599 Research Problems in Psychology. *Preq.: CI. Credits Arranged. F,S.* Research project for graduate students supervised by members of the graduate faculty. Research to be elected on basis of interest of student and is not to be part of thesis or dissertation research. Graduate Staff

FOR GRADUATES ONLY

PSY 600 Advanced Problems in Perception. *Preq.: PSY 500. 3(2-2) S. Alt. yrs.* An exploration of advanced topics in the field of perception. Specific coverage varies from year to year but may include examination of sensory/perceptual processes in audition and other non-visual systems, attentional and organizational factors in perception, information processing approaches to perception, theories of perception and/or perceptual/motor skills. Mershon

PSY 602 Physiological Psychology. *Preq.: PSY 502 and/or CI. 3(3-0) S.* PSY 602 is the sequel to PSY 502 and will concentrate on relating the neuroanatomy and neurophysiology studied in PSY 502 to overt observable behaviors such as sleep-waking, motivation-emotion and reflexive and learned behaviors. LeVere

PSY 605 Instrumental Learning. *Preqs.: PSY 510, 514. 3(3-0) S.* A systematic analysis of various experimental techniques and alternative data languages for the study of instrumental learning. Primary orientation will be upon what is happening in the experimental situation rather than upon theoretical explanations of the data. Special problems—for example, discrimination, avoidance chaining and reinforcement schedules—will be studied in depth. Various models for description of the data will be compared with special emphasis upon mathematical learning models. Cole

PSY 610 Theories of Learning. *Preqs.: PSY 510, 514. 3(3-0) F.* The objectives of this course are to promote learning of the theories currently used to explain how learning and forgetting occur so that testable consequences of these theories can be derived and so that the theories and their testable consequences are capably written and spoken about. Cole

PSY 611 Social Psychology: Small Groups Research. *Preq.: PSY 511. 3(3-0) S.* Surveys the literature and research pertaining to social psychological processes in and between groups. Course content includes basic principles of group formation, role differentiation, communication, influence, norms, social exchange, equity, cooperation/conflict, decision making and pro-social behavior. Environmental factors affecting group behavior are also considered. In conjunction with each substantive topic, the suitable methodologies for research are considered. Graduate Staff

PSY 612 Attitudes. *Preq.: Six hours grad. PSY or CI. 3(3-0) F.* Theory and research in attitude formation and change; analysis of various persuasion paradigms employed in mass communication and group influence processes; study of individual attitudinal structures, resistance to persuasion, behavior as a precursor to attitude change; attitude behavior discrepancy, attitude measurement techniques and methodological considerations. Klein

PSY 620 Advanced Problems in Cognition. *Preq.: PSY 520 or CI. 3(3-0) S.* This seminar will provide the opportunity for exploring in depth problems and issues in memory, concept learning, problem solving, psycholinguistics and other areas in cognition. Newman

PSY 635 Psychological Measurement. *Preqs.: ST 507, 511 or equivalent, 12 hours of PSY. 3(3-0) F.* Theory of psychological measurement. Statistical problems and techniques in test construction. Cunningham

PSY (IE) 640 Skilled Operator Performance. *Preqs.: PSY 545, ST 507 or ST 515. 3(3-0) F. Alt. yrs.* Theories of the human operator are considered with regard to the classical problems of monitoring, vigilance and tracking. Factors such as biological rhythm, sleep loss, sensory restriction, environmental stress and timesharing are considered as they interact with and determine overall systems efficiency. Pearson

PSY 650 Vocational Psychology. *Preqs.: ST 507, PSY 514, 635 or equivalent. 3(3-0) F. Alt. yrs.* The study of the individual's vocational behavior and development through the years of choice and adjustment. An up-to-date review and synthesis of research and theory in the field of vocational psychology. Empirical studies and theoretical statements in the field are appraised and evaluated to determine what behavioral laws apply to vocational phenomena. Westbrook

PSY 672 Personality Measurement. *Preqs.: PSY 570, 571. 3(2-3) S.* Theory and practicum in individual personality testing of child and adults with emphasis on projective techniques, other personality measures, report writing and case studies. Walker

PSY 674 Psychological Intervention I. *Preqs.: PSY 672, 530 and CI. 3(2-2) F.* This course is designed to examine theories, research, techniques, ethics and professional responsibilities related to approaches to psychological intervention. Types of psychological intervention to be studied will include behavior modification, milieu approaches, crisis intervention techniques

and group process methods, in addition to more intensive relationship approaches. A close integration of experiences, content and supervision will be emphasized in a variety of professional settings with a wide range of personal problems and age groups.

Graduate Staff

PSY 675 Psychological Intervention II. *Preq.: PSY 674. 3(2-2) S.* The primary purpose of this course is to provide students opportunities to acquire information, conceptual frameworks, interpersonal skills and a sense of ethical responsibility, all of which are basic to their further development as practicing psychologists. A major effort in the course is made to help the student increase his interpersonal skills as a means of promoting the psychological growth and effectiveness of others.

Graduate Staff

PSY 680 Systems Theory and Applications in Human Resource Development. *Preq.: PSY 594 or equivalent. 3(3-0) F.* An introduction to the systems approach and general systems theory. (1) Concepts and terminology of general systems theory, (2) techniques currently used to access system requirements and (3) methods of analyzing system performance. Emphasis will be on application of systems techniques to the design and implementation of human resource development programs.

Drewes

PSY 681 Quasi-experimental Evaluation Design. *Preq.: ST 507 or equivalent. 3(3-0) S.* An introduction to quasi-experimental design as applied to HRD program evaluation. (1) Methods of assessing informational needs, (2) recognition of internal and external validity threats, (3) design of quasi-experiments to minimize threats and (4) use of results by program decision makers.

Drewes

PSY 690 Seminar in Industrial Psychology. *3(3-0) S.* Scientific articles, analysis of experimental designs in industrial psychology and study of special problems of interest to graduate students in industrial psychology.

Graduate Staff

PSY 691 Special Topics in Psychology. *Preqs.: Grad. standing, CI. 1-3 F,S.* Course will provide opportunity for exploration in depth of advanced topical areas which, because of their degree of specialization, are not generally involved in other courses; for example, multivariate methodology in psychology, computer simulation, mathematical model building. Some new 600-level courses will first be offered under this title during the developmental phase and as such may involve lectures and/or laboratories.

Graduate Staff

PSY 693 Psychological Clinic Practicum. *Preqs.: Twelve hours in grad. PSY, which must include clinical skill courses PSY 571 and PSY 672 and/or CI. Max. 12 F,S.* Clinical participation in interviewing, counseling, psychotherapy and administration of psychological tests. Practicum to be concerned with adults and children.

Erchul, Horan, Walker

PSY 697 Advanced Seminar in Research Design. *Preqs.: Nine hours of statistical methods and research or CI, advanced grad. status. 3(3-0) F.* This course will be designed as a seminar-type course, with topics selected each semester in accordance with the interests and needs of the students. Attention will be given to the research strategies that underlie educational and psychological research, to the development of theoretical constructs, to a critical review of research related to problems in which the students are interested, and to a systematic analysis and critique of research problems in which the students are engaged.

Graduate Staff

PSY 698 Internship in Psychology. *Preqs.: Master's degree in PSY and approval of advisory committee. 1-12 F,S.* Supervised work experience in an appropriate setting with professional supervision in the field from a doctoral level psychologist with credentials and/or experience in the appropriate specialty in psychology. Experience will consist of full time for one semester or half time for an academic year or equivalent time.

Erchul, Horan, Walker

PSY 699 Thesis and Dissertation Research. *Preqs.: Grad. standing, CI. Credits arranged. F,S.* Individual research on a thesis or dissertation problem; a maximum of six credits is allowed toward the master's degree, but any number toward the Ph.D. degree.

Graduate Staff

Recreation Resources Administration

GRADUATE FACULTY

Professor M. R. Warren, Head

Associate Professor P. S. Rea, Graduate Administrator

Professors: C. D. Siderelis, R. E. Sternloff; Professors Emeriti: T. I. Hines, W. E. Smith; Associate Professor: H. A. Devine; Adjunct Associate Professor: H. K. Cordell; Associate Professors Emeriti: G. A. Hammon, L. L. Miller; Assistant Professors: D. F. Culkin, C. S. Love, R. R. Perdue, B. E. Wilson

The Department of Recreation Resources Administration offers programs of study leading to the Master of Science and Master of Recreation Resources degrees. The programs are based on an interdisciplinary approach and are designed to meet the problems and opportunities posed by changing social forces which affect the recreation profession. Students pursuing these degrees will have an opportunity to develop an understanding of the relationship between recreation and disciplines such as forestry, wildlife management, horticulture, landscape design, conservation, economics and business, politics, sociology and anthropology.

The Master of Science degree is designed to enhance in advanced students scholarly development and a more adequate comprehension of the requirements and responsibilities essential for independent research. A student will be required to complete a minimum of 30 hours of graduate work. The program will consist of a major and minor field of study. The minor may be concentrated wholly in a different discipline or may consist of courses selected from the offering of two departments. In either case, the minor field must constitute a unified pattern and must contribute to the student's education in the major field.

Each candidate for the Master of Science degree will be required to complete a thesis representing an original investigation as a part of the minimum requirements for the degree.

The Master of Recreation Resources degree is designed for students who are interested in the more advanced applications of management and organization principles in the operation of recreation and park agencies. Requirements for the Master of Recreation Resources degree include a minimum of 36 hours of course work. In lieu of a thesis the student will be required to complete additional departmental course work.

SELECTED ADVANCED UNDERGRADUATE COURSES

RRA 438 Recreation for Special Populations. *Preq.: RRA 358. 3(3-0) F.*

RRA 442 Recreation and Park Interpretive Services. *Preq.: Jr. standing. 3(2-3) F,S.*

RRA 443 Applied Recreation and Park Interpretive Services. *Preqs.: RRA 442, jr. standing. 3(1-6) S.*

RRA 451 Principles of Recreation Planning and Facilities Development. *Preq.: RRA 358. 3(2-3) F,S.*

RRA 453 Administrative Policies and Procedures. *Preq.: RRA 359. 3(3-0) F.*

RRA 454 Recreation and Park Finance. *Preqs.: Six hours of RRA courses and sr. standing. 3(3-0) S.*

RRA 480 Recreation Analysis and Evaluation. *Preqs.: RRA 359, ST 311. 3(2-2) S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

RRA 500 Theories of Leisure and Recreation. *Preq.: Nine hours of RRA courses. 3(3-0) F.* Analysis of leisure and recreation and a study of their origin and development as revealed by man's behavioral patterns. Interpretation of the influence and social significance of leisure and recreation concepts on contemporary American culture and their implications on future recreation thought and action.
Culkin, Warren

RRA 501 Research Methods in Recreation. *Preqs.: ST 311 and nine hours of RRA courses. 3(3-0) S.* Examination and understanding of advanced scientific investigative methods in their application toward explaining recreation and leisure behavioral phenomena and for the resolution of recreation management problems.
Siderelis

RRA (EB) 503 Economics of Recreation. *Preq.: EB 301 or 401. 3(3-0) F.* The principal emphasis will be on identity and importance of economic information for planning. The market mechanism and government will be examined as they affect and interact to affect allocation of resources to recreation, distribution of recreation services and behavior of recreationists. Other topics include demand analysis, economics of planning, cost/benefit analysis, secondary economic impacts, public decision making, externalities, public finance and supply considerations in urban and rural recreation situations.
Devine

RRA 504 Recreation and Park Data Systems. *Preqs.: CSC 200, ST 311; Coreq.: RRA 453. 3(3-0) F.* This course includes the analysis of such topics as the identification of maintenance, operation and service delivery work areas in recreation and park agencies for system applications; development of reporting structures; recreation and maintenance activity scheduling; system monitoring; system implementation evaluation.
Siderelis

RRA 505 Quantitative Techniques for Recreation and Natural Resource Management. *Preqs.: CSC 200, ST 311. 3(3-0) S.* A review of the application of specific management science techniques to recreation and natural resource management. Gravity, optimization, simulation and other modeling procedures will be discussed through a case study approach. The primary emphasis of the course is exposure to techniques and problem formulation rather than development of theoretical bases or computational methodologies.
Devine

RRA 510 Theories of Sport and Fitness Program Management. *Preq.: RRA 358. 3(3-0) F.* The development of a theoretical basis for sport and physical fitness program management. The sociological, psychological, political and economic considerations of sport and fitness are studied. Values and motivation of sport and fitness are stressed.
Graduate Staff

RRA 520 Concepts of Travel and Tourism. *Preq.: ST 511 or equivalent. 3(3-0) S.* Theory and research in travel and tourism, including conceptual foundations, research problems and methods and the application of research results to strategic tourism development and marketing.
Graduate Staff

RRA (LAR) 562 Computer Cartography. *Preq.: Grad. standing or CI. 3(3-0) S.* An introduction to the application of computers and associated analytic technology to problems in natural resource planning and management. The course will emphasize the use of automated mapping and display procedures in land use decision making and will involve the student in first-hand experiences with a number of different procedures and computer hardware configurations. This is not a general course in computer graphics and will deal exclusively with natural resource management applications. Devine

RRA 580 Current Issues in Recreation Resources. *Preqs.: Grad. standing, CI. 1-3 S.* An examination of current issues in recreation resources. Course content varies as changing conditions require new approaches to emerging problems. Graduate Staff

RRA 591 Recreation Resources Problems. *Preq.: Advanced undergrad. or grad. status. 1-4 F,S.* Assigned or selected problems in the field of recreation administration, planning, supervision, maintenance, operations, financing or program. Special research problems selected on basis of interest of students and supervised by members of the graduate faculty. Graduate Staff

RRA 595 Special Topics in Recreation Resources. *Preqs.: Grad. standing, CI. 1-3 F,S.* Special topics in various aspects of recreation resources are developed under direction of a graduate faculty member on a tutorial basis. Subjects offered under this course listing are also used to test and develop new courses. Graduate Staff

RRA 675 Field Studies in Recreation. *Preq.: Minimum of nine hrs. of grad. credit. 1-4 F,S,Sum.* Experience in applying analytical methods to administrative, managerial and planning problems in providing recreation and park opportunities. Completion of an evaluation project or analytical study for the practicum agency is required. Graduate Staff

FOR GRADUATES ONLY

RRA 691 Seminar in Recreation Administrative Policies. *Preq.: RRA 501 or equivalent. 2(0-4) F.* Advanced course in administrative principles; students conduct supervised individual and group research in specific administrative categories of study in the field of recreation. Independent study and research required of students who must develop written and oral presentations for critical analysis by graduate students and faculty. Rea

RRA 692 Advanced Problems in Recreation. *Preq.: Twelve hours of RRA courses. Credits Arranged. F,S.* Directed research in a specialized phase of recreation other than a thesis problem. Graduate Staff

RRA 696 Seminar in Recreation Research. *Preq. or coreq.: RRA 501. 1(2-0) S.* Research studies, scientific articles and progress reports on research effects presented and critically evaluated. Each student pursuing a graduate degree is expected to take this offering twice for one hour of credit each time.

RRA 699 Research in Recreation. *Preq.: Twelve hours of RRA courses. Credits Arranged. F,S.* Original research preliminary to writing a master's thesis. Graduate Staff

Sociology and Anthropology

GRADUATE FACULTY

Professor C. P. Marsh, Acting Head

Associate Professor M. L. Walek, Assistant Head

Professor R. L. Moxley, Graduate Administrator

Professors: W. B. Clifford II, V. E. Hamilton, V. A. Hiday, T. N. Hobgood Jr., G. C. McCann, P. N. Reid, M. M. Sawhney, E. M. Suval, O. Uzzell, M. E. Volland, R. C. Wimberley; *Professors Emeriti:* L. A. Drabick, H. D. Rawls, J. N. Young; *Associate Professors:* R. C. Brisson, A. C. Davis, L. R. Della Fave, S. K. Garber, J. C. Leiter, G. S. Nickerson, I. Rovner, M. D. Schulman, R. J. Thomson, K. M. Troost, J. M. Wallace, E. M. Woodrum, M. T. Zingraff; *Associate Professor Emeritus:* J. G. Peck; *Assistant Professors:* M. P. Atkinson, C. G. Dawson, R. S. Ellovich, G. D. Hill, F. M. Howell, T. M. Hyman, S. C. Lilley, B. J. Risan, D. Tomaskovic-Devey

ASSOCIATE MEMBER OF THE DEPARTMENT

Professor R. D. Mustian

The Department of Sociology and Anthropology offers programs of study in sociology leading to the advanced degrees of Master of Sociology, Master of Science and Doctor of Philosophy. The core program includes sociological theory, research methods and quantitative analysis. Other major areas of concentration include community and regional development, demography and ecology, deviance and criminology, sociology of agriculture and rural sociology, sociology of development and social change, social organization, social psychology and sociology of the family.

The Master of Science and Doctor of Philosophy degrees are oriented to the basic and applied science of sociology. Special attention is given to sociological skills for analyzing social factors and policies affecting informal groups, formal organizations, families, communities, regions, nations and international development. The Master of Sociology is designed for applied sociology careers in local, state and federal agencies; management and administration; human service delivery; program development and evaluation; and the teaching of sociology in secondary schools. The program focuses on the application of sociological theory, methods and research to social issues and problems. A practicum gives the student experience in an agency/organization.

The department also offers a minor in cultural anthropology at the Master's level. Graduate courses are designed to give a broad background in major concepts of cultural anthropology with emphasis on theory. These offerings may be supplemented with courses in geographic areas and methodology at the 400 level.

Computer facilities are available to graduate students and faculty in the department as described under "Computing Facilities." Graduate students on assistantships and fellowships are normally provided office facilities. Research opportunities reflect the wide range of interests of the graduate faculty and the imagination of the students themselves. The department also has a statewide extension focus in applied sociology.

SELECTED ADVANCED UNDERGRADUATE COURSES

ANT 416 Research Methods in Cultural Anthropology. *Req.: Six hours ANT. 3(3-0).*

ANT 420 Biological Bases for Human Social Behavior. *Preq.: ANT 251, or BS 100 or 105, GN 301, or equivalent. 3(3-0).*

ANT 498 Special Topics in Anthropology. *Preq.: Six hours of SOC/ANT. 1-6.*

SOC 402 Urban Sociology. *Preq.: SOC 202. 3(3-0).*

SOC 410 Formal Organizations. *Preq.: SOC 202. 3(3-0).*

SOC 414 Social Class. *Preq.: SOC 202. 3(3-0).*

SOC 415 Social Thought. *Preq.: SOC 202. 3(3-0).*

SOC 416 Research Methods. *Preqs.: Sr. standing, ST 311, or CI. 3(3-0).*

SOC 418 Analysis of School-Community Relations. *Preq.: SOC 202 or SOC 318 or SOC 311 or ED 344. 3(2-2).*

SOC 420 Sociology of Corrections. *Preqs.: SOC 306 and PS 311. 3(3-0).*

SOC 425 Juvenile Delinquency. *Preq.: SOC 202, SOC 301 desirable. 3(3-0).*

SOC 440 Social Change. *Preq.: SOC 202. 3(3-0).*

SOC 441 Social Change in Asia. *Preq.: SOC 202. 3(1-1).*

SOC 490 Senior Seminar in Sociology. *Preqs.: Sr. standing and consent of department. 3(3-0).*

SOC 498 Special Topics in Sociology. *Preq.: Six hours SOC above 200 level. 1-6.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ANT 501 Advanced Survey of Cultural Anthropology. *Preq.: Grad. standing or PBS status. 3(3-0).* An intensive examination of the field of cultural anthropology. As a foundation course for subsequent graduate work in anthropology, emphasis will be placed on main currents in anthropological thinking and research
Graduate Staff

ANT 505 Comparative Social Organization. *Preq.: ANT 501 or 6 hours in Cultural Anthropology. 3(3-0).* This course will focus on an analysis of forms of social organization in both technologically simple and complex societies from several analytical perspectives. Discussion of kinship theory: the relationship of social organization to systems such as the economic, political and religious; and an examination of modern development in social organization research will be stressed.
Graduate Staff

ANT 508 Culture and Personality. *Preq.: ANT 501 or 6 hours in Cultural Anthropology. 3(3-0).* The course focuses on the interplay between cultural norms and the enculturation process. From a cross-cultural perspective, it examines the process by which cultural norms are transmitted and learned, as well as the effect of culture change on the individual. The historical development of the field as well as contemporary trends are also discussed in both theoretical and applied contexts.
Graduate Staff

ANT 511 Anthropological Theory. *Preqs.: ANT 501 or 6 hours in Cultural Anthropology. 3(3-0).* Approaches theory from both an historical and contemporary point of view. Emphasizes the key anthropological concept of culture and its significance for understanding man and his works.
Graduate Staff

ANT 512 Applied Anthropology. *Preq.: ANT 252 or CI. 3(3-0).* Includes a review of the historical development of applied anthropology and a study of anthropology as applied in government, industry, community development, education and medicine. The processes of cultural change are analyzed in terms of the application of anthropological techniques to programs of developmental change.
Graduate Staff

ANT 591 Special Topics in Anthropology. *Preq.: ANT 501 or equivalent. 1-6.* This course is designed to provide the opportunity for students to investigate in depth some particular topic in anthropology. Course content and mode of study will vary, reflecting current student needs and interests. Topics will be determined by the faculty member(s) and student.
Graduate Staff

SOC 501 Leadership. *Preq.: SOC 202 or equivalent. 3(3-0).* Leadership in various fields of American life; analysis of factors associated with it; techniques of leadership. Stresses recreational, scientific and executive leadership procedures.
Graduate Staff

SOC 502 Society, Culture and Personality. *Preq.: SOC 202 or equivalent. 3(3-0).* Studies human personality from its origins in primary groups through its development in secondary contacts and its ultimate integration with social norms. Explores comparative anthropological materials but places emphasis on the normal personality and individual adjustment to our society and culture. Dynamics of personality and character structure analyzed in terms of society's general culture patterns and social institutions.
Graduate Staff

SOC 503 Contemporary Sociology. *Preq.: Grad. standing or PBS status. 3(3-0).* An overview of the current status of sociological theory and research. Introduction to contemporary sociological thinking and research.
Graduate Staff

SOC 504 Education in Modern Society. *Preqs.: SOC 202, 301 or equivalent. 3(3-0).* Places varying emphasis on the historical development of education in the United States, cross-cultural comparisons of educational structure and function, professionalization of educators, investigation of the ecological factors affecting education, effects of group processes upon learning and the effects of social processes and changes upon the educational institution.
Graduate Staff

SOC 505 Medical Sociology. *Preq.: Six credits in SOC or grad. standing or PBS status. 3(3-0).* Advanced sociological analysis of health care organizations and their systemic linkage to other community institutions. Measurement of health and illness and their social significance. Applications of sociological and social-psychological theories to practitioner-client relationships and interaction. Implications of alternative models of health care provision.
Graduate Staff

SOC 506 The Sociology of Rehabilitation. *Preq.: Grad. standing or PBS status. 3(3-0).* Students engage in individual research projects on a specific handicap, a rehabilitation process or a rehabilitative agency or subagency. Lectures and discussions furnish perspective concerning rehabilitation work in process while student pursues a specialized interest. Emphasizes sociological methods and techniques applicable to above aspects of social behavior.
Graduate Staff

SOC 507 Social Movements. *Preq.: SOC 503 or 6 hours of SOC or social psychology. 3(3-0).* Major topics include: the nature and variety of social movements; conditions affecting the emergence of social movements; the structure of social movements; and the relationship between social movements, social conflict and social change. While the primary emphasis will be conceptual and theoretical, a number of social movements both past and contemporary will be examined within this framework. Similarly, research issues relative to social movements will be examined.
Graduate Staff

SOC 509 Population Problems. *Preq.: SOC 202 or equivalent. 3(3-0).* Examines population growth, rates of change and distribution. Emphasizes functional roles of population, *i.e.*, age, sex, race, residence, occupation, marital status and education. Population dynamics are stressed: fertility, mortality and migration. Population policy is analyzed in relation to national and international goals stressing a world view. Graduate Staff

SOC 510 Industrial Sociology. *Preq.: SOC 202 or equivalent. 3(3-0).* Industrial relations are analyzed as group behavior with a complex and dynamic network of rights, obligations, sentiments and rules. This social system is viewed as an interdependent part of total community life. The background and functioning of industrialism are studied as social and cultural phenomena and its social problems are analyzed. Graduate Staff

SOC 511 Sociological Theory. *Preqs.: Six hours SOC and grad. standing or PBS status. 3(3-0).* The interdependence of theory and method; the major theoretical and methodological systems. Examines selected cases of research in which theory and method are classically combined. Graduate Staff

SOC 512 Family Analysis. *Preq.: SOC 202 or equivalent. 3(3-0).* Examines the basic theoretical and methodological framework in sociology within which contemporary family research is conducted. Graduate Staff

SOC 513 Community Organization and Development. *Preq.: SOC 202 or equivalent. 3(3-0).* Community organization is viewed as a process of bringing about desirable changes in community life. Community needs and resources are studied. Democratic processes in community action and principles of organization are stressed, along with techniques and procedures. Roles of lay and professional workers are analyzed. Graduate Staff

SOC 514 Developing Societies. *Preq.: Six hours SOC or ANT or grad. standing or PBS status. 3(3-0).* Defines major problems posed for development sociology and explores the social barriers and theoretical solutions for development set forth with regard to the newly-developing countries. Significant past strategies reviewed and main themes in current development schemes presented. Untested strategies for the future proposed and discussed. These problems are examined in their national and international contexts. Graduate Staff

SOC 515 Deviant Behavior. *Preq.: Six hours SOC or ANT or grad. standing or PBS status. 3(3-0).* Topics include: the inevitability of deviance and its social utility; cross-cultural variations in appearance and behavioral cues for labeling the deviant; descriptive and explanatory approaches to kinds and amounts of deviance in contemporary American society; social change, anomie and social disorganization theories; the process of stigmatization; formal and informal societal responses to deviance and the deviant; social action implications. Graduate Staff

SOC 516 Social Control. *Preq.: Six hours SOC above 200 level or grad. standing or PBS status. 3(3-0).* The need, functions, utilization and effects of both informal and formal social control mechanisms are examined. Theoretical perspectives on social control and the empirical support for these positions are emphasized and critically evaluated. Graduate Staff

SOC (PS) 517 The Police Bureaucracy in a Democratic Society. *3(3-0).* (See political science and public administration.)

SOC 520 Sociology of Religion. *Preq.: SOC 202 or equivalent or grad. standing or PBS status. 3(3-0).* Alternative theoretical analyses are presented for religious beliefs, practices and organizations and the relationships between these and other social phenomena. The utility and deficiencies of each conceptual framework are assessed through general applica-

tions and case studies. Major research findings in this classical field of sociology are reviewed. Contemporary trends and issues concerning religion in society are addressed.

Graduate Staff

SOC 523 Sociological Analysis of Agricultural Land Tenure Systems. *Preq.: Three hours SOC. 3(3-0).* A systematic sociological analysis of the major agricultural and land-tenure systems of the world with emphasis on problems of U.S. family farm ownership and tenancy.

Graduate Staff

SOC 533 Theory of Human Communication Behavior. *Preqs.: Six hours SOC or social psychology and grad. standing or PBS status. 3(3-0).* The behavioral science approach to understanding human communication which is treated as a basic social psychological process in which communication events are analyzed in terms of their effects on individual, interpersonal and group behavior. Surveys theory, research methods and empirical findings. Communication behavior as a mediating mechanism in social interactions.

Graduate Staff

SOC 534 Agricultural Organizations and Movements. *Preqs.: Three hours SOC, American history, American government or a related social science or consent of department. 3(3-0).* A history of agricultural organizations and movements in the United States and Canada principally since 1865, emphasizing the Grange, the Farmers' Alliance, the Populist revolt, the Farmers' Union, the Farm Bureau, the Equity societies, the Nonpartisan League, cooperative marketing, government programs and present problems.

Graduate Staff

SOC 541 Social Systems and Planned Change. *Preq.: Three hours SOC. 3(3-0).* An examination of social systems within the framework of both functional theory and conflict theory, with particular emphasis upon system change and the planning of social change.

Graduate Staff

SOC 555 Social Stratification. *Preq.: Six hours SOC. 3(3-0).* The theoretical background, methodological approaches and analysis of the consequences of systems of stratification. Emphasizes the static and dynamic qualities of stratification systems on relations within and between societies. Attention to the integrative and divisive quality of stratification as it is expressed in life styles, world views, etc.

Graduate Staff

SOC 560 Racial and Cultural Contacts. *Preq.: Six hours SOC or CI. 3(3-0).* 1) Examines intergroup relations as a legitimate concern of the social sciences, 2) Appraises cross-cultural data drawn from a variety of situations wherein race and ethnicity figure in a significant manner, 3) Attempts to interpret data by delineating observable patterns, trends and relationships.

Graduate Staff

SOC 565 Sociology and General Systems Theory. *Preqs.: Six hours SOC, one ST course. 3(3-0).* Examines the basis of general systems theory and its application in the sociological fields. Emphasizes the philosophical nature of systems theory and its potential as an alternative conceptualization to mechanistic and organismic models. Scrutinizes the underlying basis of systems theory; cybernetics as models of change and control; learning and equilibrium; information theory as models of choice and selection; decision theory and game theory.

Graduate Staff

SOC 570 Commitment. *Preq.: Six hours SOC. 3(3-0).* The process of commitment and its strength is covered for several theoretical views as applicable to collective behavior, social movements, the sociology of religion, political sociology, deviance, attitudes, decision making, dissonance, structural effects and other topics. An aim is to construct propositions and testable models of the commitment process.

Graduate Staff

SOC (EB) 574 The Economics of Population. *3(3-0).* (See economics and business.)

SOC 590 Applied Research. *Preq.: SOC 202 or equivalent. 3(3-0).* Studies research process with emphasis upon its application to action problems. The development of research design to meet action research needs is stressed. Graduate Staff

SOC 591 Special Topics in Sociology. *Preq.: CI. 1-6.* An examination of current problems organized on a lecture-discussion basis. Course content varies as changing conditions require new approaches to emerging problems. Graduate Staff

SOC 592 Demographic Structure and Processes. *Preq.: SOC 509 or equivalent. 3(3-0).* Explores in depth the major demographic variables (size, composition and distribution) and basic demographic processes (fertility, mortality and migration). Attention to theoretical and methodological considerations as well as to current substantive knowledge. Specific course content varies depending upon student needs and interests. Graduate Staff

SOC 595 Practicum in Sociology. *Preqs.: Grad. standing in the Master of Sociology program and 9 hours of SOC at the 500-600 level. 3-6.* Opportunity for student under the supervision of graduate advisory committee chairman and organization/agency supervisor to develop and demonstrate competency in the area of graduate specialization through application of sociological knowledge to practical problems facing the organization/agency. Graduate Staff

FOR GRADUATES ONLY

SOC 601 Urban Ecology. *Preq. SOC 509. 3(3-0).* The course involves an historical approach to the development of the field as well as an analysis of the present state of the field. Because of the range of subject matter subsumed under the topic of ecology, the linkages between sociology and other disciplines concerning themselves with the subject will be delineated and examined. Graduate Staff

SOC 611 Research Methods in Sociology. *Preqs.: SOC 416, ST 311 or equivalent. 3(3-0).* Designed to give the student a mature insight into the nature of scientific research in sociology. Assesses the nature and purpose of research designs, the interrelationship of theory and research, the use of selected techniques and their relation to research designs and the use of modern tabulation equipment in research. Graduate Staff

SOC 612 Scaling and Indexing for Social and Behavioral Data. *Preqs.: ST 311, SOC 416 or equivalent. 3(3-0).* A basic introduction to the theory of measurement and scaling and to types of simple and composite measures used in the social and behavioral sciences. The development and utility of simple and composite indexes, paired comparison, equal appearing interval, summated rating cumulative, factor, latent structure and self-anchoring scales will be examined by means of problems and examples. Graduate Staff

SOC 613 Theory of Mass Communication. *Preq.: SOC 533 or equivalent. 3(3-0).* This course provides the advanced student in the social sciences with an opportunity to examine the emerging body of theory and research in the field of mass communications. Course content will treat: (1) the systems character of mass communication, (2) social communication at the individual and group level, (3) persuasive communication and social control, (4) communication and opinion change and (5) communication and societal development. In addition to the theoretical and methodological underpinnings drawn from the behavioral sciences, the course will examine contributions from the communication arts and applied communications. Graduate Staff

SOC 615 Research on Crime and Deviance. *Preq.: SOC 515 or equivalent. 3(3-0).* Major topics include: an examination of conceptual problems and research issues and methods in the study of crime and deviance; an assessment of current research on crime causation and deviance processes; an examination of research on social control processes and agencies; and

an assessment of social action and evaluative research. A variety of substantive topics will be dealt with in the context of the above topical areas including: delinquency, drug usage, mental illness, obesity, stuttering, suicide, prostitution, homicide and rape. Graduate Staff

SOC 621 Social Psychology. *Preq.: Six hours SOC. 3(3-0).* The objective of this course is to present the major ideas of social psychology in the context of the theoretical orientations from which they have emerged. The nature and role of theory in social psychology are examined. The social psychologies of various theorists are then examined in terms of their particular approaches including the Gestalt, Field, Role, Psychoanalytic and Reinforcement orientations and combinations of these. Graduate Staff

SOC 631 Population Analysis. *Preq.: SOC 509 or equivalent. 3(3-0).* Methods of describing, analyzing and presenting data on human populations: distribution, characteristics, natural increase, migration and trends in relation to resources. Graduate Staff

SOC 632 Sociology of the Family. *Preq.: Six hours SOC. 3(3-0).* Emphasis is placed on the development of an adequate sociological frame of reference for family analysis; on discovering both the uniquely cultural and common-human aspects of the family by means of cross-cultural comparisons; on historical explanations for variability in American families with special concern for the family; and on analyzing patterns of family stability and effectiveness. Graduate Staff

SOC 633 The Community. *Preq.: Six hours SOC. 3(3-0).* The community is viewed in sociological perspective as a functioning entity. A method of analysis is presented and applied to eight "dimensions," with emphasis on the unique types of understanding to be derived from measuring each dimension. Finally, the effect of change on community integration and development is analyzed. Graduate Staff

SOC 641 Statistics in Sociology. *Preq.: ST 513 or equivalent. 3(3-0).* The application of statistical methods of sociological research. Emphasis on selecting appropriate models, instruments and techniques for the more frequently encountered problems and forms of data. Graduate Staff

SOC 645 Advanced Sociological Measurement. *Preqs.: SOC 611; ST 511 or 513. 3(3-0).* Various issues concerning the measurement of social variables are examined and techniques are described. These issues and techniques include operationalism and epistemic correlation, levels of measurement, transformations, social indicators, scaling, dimensionality, validity and reliability. Existing examples and potential applications in sociological research are considered. Graduate Staff

SOC 646 Advanced Sociological Analysis. *Preqs.: SOC 611; ST 511 or 513. 3(3-0).* Advanced analysis techniques adaptable to the needs of sociological research are examined. Special attention is given to causal analysis, the analysis of change, and aggregate *versus* individual level data analyses. Sociological examples are considered. Emerging issues and techniques are given attention. Graduate Staff

SOC 650 Contemporary Sociological Theory. *Preq.: SOC 511 or equivalent. 3(3-0).* Works by major figures who represent leading schools of sociological theory in the post-World War II period are studied as primary sources. Underlying assumptions are made explicit, the structure of the theory, including propositions, are examined critically, and relationships with other theoretical perspectives are discussed. Graduate Staff

SOC 652 Comparative Societies. *Preq.: Six hours SOC. 3(3-0).* Sociological analysis of societies around the world with particular reference to North and South America. Special emphasis is given to cultural and physical setting, population composition, levels of living, relationship of the people to the land, structure and function of the major institutions and forces making for change. Graduate Staff

SOC 653 Theory and Development of Sociology. *Preqs.: SOC 511, CI. 3(3-0).* Detailed analysis of methodological and substantive problems in utilizing sociological theories in varied areas, and an examination of events and trends in the development of sociology.

Graduate Staff

SOC 655 Theory Construction. *Preq.: SOC 511 or equivalent. 3(3-0).* Provides students with a capability to develop theoretical frames of reference within which to devise and implement research activities. Acquaints students with the philosophical and disciplinary bases of theory, establishes the relationship between theory and research and enables objective evaluation of theoretical positions encountered in the literature.

Graduate Staff

SOC 670 Theories of Population. *Preq.: SOC 509 and/or SOC 511 or CI. 3(3-0).* This course provides an overview of population theory utilizing a combined chronological and topical approach. Major topics include: sociological analysis of ancient and medieval views of population; mercantilism and population; economic, utopian, philosophical and biological theories of population in the 18th century; Malthusian theory; and post-Malthusian theory, including biological, anthropological, mathematical, economic, political, historical and especially social and social-psychological approaches.

Graduate Staff

SOC 671 Social Demography. *Preq.: SOC 509 or 631 or equivalents. 3(3-0).* The basic purpose of this course is to develop on the part of the student an appreciation of the sociological variables capable of being used in demographic research and to provide an overview of the current substantive knowledge concerning social and demographic systems, social action systems and social aggregate systems.

Graduate Staff

SOC 690 Seminar. *Credits Arranged.* Appraisal of current literature; presentation of research papers by students; progress reports on departmental research; review of developing research methods and plans; reports from scientific meetings and conferences; other professional matters.

Graduate Staff

SOC 699 Research in Sociology. *Preq.: Consent of chairman of graduate study committee. Credits Arranged.* Planning and execution of research and preparation of manuscript under supervision of graduate committee.

Graduate Staff

Soil Science

GRADUATE FACULTY

Professor R. H. Miller, Head

Professors: S. W. Buol, D. K. Cassel, M. G. Cook, F. R. Cox, G. A. Cummings, C. B. Davey, J. W. Gilliam, W. A. Jackson, E. J. Kamprath, C. B. McCants, J. A. Phillips, C. D. Raper Jr., P. A. Sanchez, E. D. Seneca, R. W. Skaggs, R. J. Volk, J. B. Weber, S. B. Weed, A. G. Wollum II; *Extension Professor:* J. V. Baird; *Visiting Professor:* R. B. Daniels; *Professors Emeriti:* W. V. Bartholomew, R. W. Cummings, J. W. Fitts, J. F. Lutz, W. G. Woltz, W. W. Woodhouse Jr.; *Associate Professors:* L. D. King, R. Lea, R. E. McCollum, G. S. Miner, G. C. Naderman, J. E. Shelton; *Associate Professor (USDA):* D. W. Israel; *Extension Associate Professor:* H. J. Kleiss; *Adjunct Associate Professor:* D. W. Eaddy; *Assistant Professors:* H. L. Allen Jr., A. Amoozegar-Fard, S. W. Broome, H. P. Denton, G. D. Hoyt, C. K. Martin, L. A. Morris, W. P. Robarge, M. V. Vepraskas; *Visiting Assistant Professors:* T. J. Smyth, M. K. Wade

The Department of Soil Science offers graduate programs leading to the Master of Science and Doctor of Philosophy degrees. These are research-oriented degrees and require a thesis/dissertation based on individual research on some aspect of the science. In addition, the Master of Agriculture and Master of Life Sciences degrees (non-thesis) may be obtained through the department.

Each M.S. and Ph.D. student will participate in one of many active research projects supervised by personnel in the department. The research may be specialized in one of the traditional sub-disciplines, *e.g.*, soil chemistry or it may integrate subject matter from related disciplines to address current societal needs, *e.g.*, waste management. Several of the projects are interdepartmental in character and, thus, a student may develop a particularly strong supportive program in one of the cooperating departments.

The department provides opportunities for students to tailor their programs for careers in research, teaching, extension or international programs. A student A student interested in one of these areas is encouraged to add this special dimension to the research emphasis required of all students. Arrangements for these opportunities are made on an individual basis with appropriate faculty.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

SSC 501 Tropical Soils: Characteristics and Management. *Preq.: Six credits in SSC. 3(3-0) S.* Characteristics of the tropical environment. Distribution and classification of tropical soils. Soil plant relationships in the tropics. Soil management systems emphasizing shifting cultivation, flooded rice production, subsistence farming and tropical pasture management.

Sanchez

SSC 511 Soil Physics. *Preqs.: SSC 200, PY 212. 4(3-3) F.* The study of soil physical properties and theory of selected instrumentation to measure them. Topics include soil solids, soil water, air and heat. Transport processes and the energy concept of soil and water are emphasized.

Cassel

SSC 520 Soil and Plant Analysis. *Preqs.: PY 212; CH 315; at least three soils courses including SSC 341 or CI. 3(2-3) S. Alt. yrs.* Theory and advanced principles of the utilization of chemical instruments to aid research on the heterogeneous systems of soils and plants.

Gilliam

SSC 522 Soil Chemistry. *Preqs.: SSC 200, one year of general inorganic chemistry. 3(3-0) S.* A consideration of the chemical and colloidal properties of clay and soil systems, including ion exchange and retention, soil solution reactions, solvation of clays and electrokinetic properties of clay-water systems.

Weed

SSC (MB) 532 Soil Microbiology. *Preqs.: MB 401; CH 220 or CI. 4(3-3) S.* Soil as a medium for microbial growth, the relation of microbes to important mineral transformations in soil, the importance of biological equilibrium and significance of soil microbes to environmental quality.

Wollum

SSC 541 Soil Fertility. *Preq.: SSC 341. 3(3-0) F.* Soil conditions affecting plant growth and the chemistry of soil and fertilizer interrelationships. Factors affecting the availability of nutrients. Methods of measuring nutrient availability.

Kamprath

SSC 551 Soil Morphology, Genesis and Classification. *Preqs.: MEA 120, SSC 200, SSC 341. 3(3-0) F.* Morphology: Chemical, physical and mineralogical parameters useful in characterizing soil. Genesis: Soil-forming factors and processes. Classification: Historical development and present concepts of soil taxonomy with particular reference to worldwide distribution of great soil groups as well as discussions of logical bases of soil classification.

Buol

SSC 553 Soil Mineralogy. *Preqs.: SSC 200, SSC 341, MEA 330. 3(2-3) F.* Composition, structure, classification, identification, origin, occurrence and significance of soil minerals with emphasis on primary weatherable silicates, layer silicate clays and sesquioxides.

Weed

SSC 560 Advanced Soil Management. *Preqs.: SSC 200, 341. 3(3-0) Sum. Alt. yrs.* Studies of soil characteristics in the coastal plain, piedmont and mountain areas of North Carolina. Discussion of management practices that should be associated with various soils for different types of enterprises. Two overnight field trips are required.

Graduate Staff

SSC 590 Special Problems. *Preq.: SSC 200. Credits Arranged. F,S.* Special problems in various phases of soils. Emphasis will be placed on review of recent and current research.

Graduate Staff

FOR GRADUATES ONLY

SSC (CS, HS) 614 Herbicide Behavior in Plants and Soils. *3(3-0) F.* (See crop science.)

SSC (MB) 632 Ecology and Functions of Soil Microorganisms. *Preqs.: MB 401, SSC (MB) 532 or equivalent. 3(3-0) S. Alt. yrs.* A comprehensive examination of theories and concepts relative to ecology and functions of soil microorganisms. Topics include relationships of microbes to their environments, adaptive mechanisms, microbial processes in soil organic matter formation and degradation, and function of organic matter in soil systems. Subject emphasis will be determined by class interests and by current literature.

Graduate Staff

SSC 651 Pedology. *Preqs.: SSC 522, 511; SSC 551 or equivalent. 3(3-0) S. Alt. yrs.* A critical study of current theories and concepts in soil genesis, morphology and classification.

Buol

SSC (BAE) 671 Theory of Drainage—Saturated Flow. *3(3-0) F. Alt. yrs.* (See biological and agricultural engineering.)

SSC 672 Soil Properties and Plant Development. *Preqs.: BCH 551, SSC 522 or equivalent. 3(3-0) S. Alt. yrs.* An examination of the interrelationships of soil properties and plant characteristics which regulate inorganic ion accumulation and dry matter production in higher plants.

Jackson

SSC (FOR) 673 Advanced Forest Soils. *3(2-3) F. Alt. yrs.* (See forestry.)

SSC (BAE) 674 Theory of Drainage—Unsaturated Flow. *3(3-0) S. Alt. yrs.* (See biological and agricultural engineering.)

SSC 690 Seminar. *Preq.: Grad. standing in SSC. 1(1-0) F,S.* A maximum of two semester hours is allowed toward the master's degree, but any number toward the doctorate. Scientific articles, progress reports in research and special problems of interest to soil scientists reviewed and discussed.

Graduate Staff

SSC 693 Colloquium in Soil Science. *Preq.: Grad. standing in SSC. Credits Arranged. F,S.* Seminar-type discussions and lectures on specialized and advanced topics in soil science.

Graduate Staff

SSC 699 Research. *Preq.: Grad. standing in SSC. Credits Arranged. F,S.* A maximum of six semester hours is allowed toward the master's degree but any number towards the doctorate.
Graduate Staff

Special Education

For information on this program, see special education under education.

Statistics

GRADUATE FACULTY

Professor D. L. Solomon, Head

Professor T. M. Gerig, Graduate Administrator

Professors: B. B. Bhattacharyya, P. Bloomfield, C. C. Cockerham, A. R. Gallant, F. G. Giesbrecht, H. J. Gold, M. M. Goodman, W. L. Hafley, T. Johnson, A. R. Manson, L. A. Nelson, C. H. Proctor, C. P. Quesenberry, J. O. Rawlings, D. L. Ridgeway, H. R. van der Vaart, J. L. Wasik, B. S. Weir, O. Wesler; *Adjunct Professor:* A. L. Finkner; *Professors Emeriti:* A. H. E. Grandage, R. J. Hader, D. W. Hayne, D. D. Mason, F. E. McVay, R. J. Monroe, J. A. Rigney, R. G. D. Steel; *Associate Professors:* R. L. Berger, D. D. Boos, K. P. Burnham, D. A. Dickey, E. J. Dietz, A. C. Linnerud, J. F. Monahan, K. H. Pollock, T. W. Reiland, W. H. Swallow, M. Wann; *Adjunct Associate Professors:* J. R. Chromy, H. L. Crutcher, J. H. Goodnight; *Assistant Professors:* C. Brownie, T. H. Emigh, F. M. Guess, D. W. Nychka, S. G. Pantula, C. E. Smith

The Department of Statistics offers programs leading to the Master of Science and Doctor of Philosophy degrees in both statistics and biomathematics and to the Master of Statistics and Master of Biomathematics degrees. It also offers co-major and joint Ph.D. programs with other departments including economics and business, crop science, genetics, biomathematics, operations research, forestry and computer studies. Flexible minor programs in statistics are offered at the Master's and Ph.D. levels. With a faculty of 36 representing virtually all major statistical specializations, the department is recognized as a world leader in graduate education and research in statistics. Its applied orientation sets it apart from most other departments in the country, offering training to those wishing to pursue careers as consulting statisticians in industry and government as well as to those seeking careers in research and teaching.

Areas of research specialization of the faculty and advanced graduate students include time series, biomathematics, econometrics, quantitative genetics and ecology, experimental design and analysis, multivariate analysis, sampling, life science applications, statistical computing, parametric modeling, robust and non-parametric inference, mathematical programming, Bayesian inference, decision theory and stochastic processes.

The department provides consulting services to many other departments. This function places the department in a unique position in the University community, offering opportunities for collaboration and providing students with hands-on consulting experiences.

In addition to its ongoing program, the department houses three special groups. The Biomathematics Graduate Program, which is described under biomathematics, offers its own degrees and supports a research program. The Quantitative Genetics Research Program is an internationally respected research group of faculty, post-doctoral fellows and graduate students. The Southeastern Cooperative Fish and Game Statistics Project provides statistical consulting services to wildlife agencies in the southeast. Training and research in wildlife statistics are supported through this project.

The well-prepared applicant to the department's Master's program has good grades in a three-semester calculus sequence, a two-semester advanced calculus sequence, a semester of linear algebra and a two-semester applied statistics sequence. Some of these courses can be taken as part of the program but this may result in lengthening the stay. Admission to our Ph.D. program is granted to students who have passed the departmental Basic Comprehensive Examination at the Ph.D. level. A suitably prepared student can complete the Master's degree in two years. The Ph.D. usually requires two years beyond the Master's.

Departmental assistantships and fellowships are awarded each year on a competitive basis. Fellowships are provided through the Department's Gertrude M. Cox Fellowship Fund. Approximately 15 teaching assistantships and 15 research assistantships are also available.

Extensive library facilities are available in the area including the University's D. H. Hill Library, the Statistics departmental library, and those at Duke University and the University of North Carolina at Chapel Hill.

The department offers extensive computing support to its faculty and students. Its facilities include access to mainframe computers (IBM 3081 and 4341) and the department microcomputer (DEC VAX-11/750) via terminals located in our computing laboratory and individual offices. A Tektronix 4010-1 graphics terminal and 4662A 8-pen flat-bed plotter provide excellent graphics output capabilities. Microcomputers in use in the department include numerous IBM-PC, PC-XT and PC-AT stations. A wide range of processing capabilities are available, including interactive computing via TSO, WYLBUR, CMS, VMS or EUNICE (a UNIX look-alike); higher level languages FORTRAN, PL/1, APL, PASCAL, LISP, C and many more; a variety of statistical packages and graphics systems such as SAS, BMDP, SPSS, IMSL DI-3000 and S.

Currently, employment opportunities are excellent for statisticians trained at all levels. The department regularly receives notification of job openings from industry, government and academic institutions. The National Science Foundation predicts a shortage of statisticians in the coming years.

SELECTED ADVANCED UNDERGRADUATE COURSES

ST 401, 402 Basic Statistical Analysis. *Req.: (401) ST 302 or 372; (402) ST 401. 3(3-0) F,S.*

ST 421, 422 Introduction to Mathematical Statistics. *Preq.: (421) MA 202 or MA 212; (422) ST 421. 3(3-0) F,S.*

ST 493 Special Topics in Statistics. *Preq.: CI. 1-3 F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ST 505 Applied Nonparametric Statistics. *Preq.: ST 372 or ST 511. 3(3-0) S.* Statistical methods that require relatively mild assumptions about the form of the population distribution. Hypothesis testing, point and interval estimation and multiple comparison procedures for a variety of statistical problems. Dietz

ST (ZO) 506 Sampling Animal Populations. *Preq.: ST 512. 3(3-0) F. Alt. yrs.* Statistical methods applicable to sampling of wildlife populations, including capture-recapture, removal, change in ratio, quadrat and line transect sampling. Emphasis on model assumptions and study design. Pollock

ST 507 Statistics for the Behavioral Sciences I. *3(3-0) F.* A general introduction to the use of descriptive and inferential statistics in behavioral science research. Methods for describing and summarizing data are presented, followed by procedures for estimating population parameters and testing hypotheses concerning the summarized data. Dietz, Wasik

ST 508 Statistics for the Behavioral Sciences II. *Preq.: ST 507 or CI. 3(3-0) S.* The use of statistical design principles in behavioral science research is introduced. The use of a statistical model to represent the structure of data collected from a designed experiment or survey study is presented. Opportunities are provided for use of a computer to perform analyses of data to evaluate the proposed statistical model and to assist in post-hoc analysis procedures. Least squares principles are used to integrate the topics of multiple linear regression analysis, the analysis of variance and analysis of covariance. Wasik

ST 511 Experimental Statistics for Biological Sciences I. *Preq.: ST 311 or grad. standing. 3(3-0) F,S.* Basic concepts of statistical models and use of samples; variation, statistical measures, distributions, tests of significance, analysis of variance and elementary experimental design, regression and correlation, chi-square. Graduate Staff

ST 512 Experimental Statistics for Biological Sciences II. *Preq.: ST 511 or equivalent. 3(3-0) F,S.* Covariance, multiple regression, curvilinear regression, concepts of experimental design, factorial experiments, confounded factorials, individual degrees of freedom and split-plot designs. Graduate Staff

ST 513 Experimental Statistics for Social Sciences I. *Preq.: ST 311 or grad. standing. 3(3-0).* Basic ideas of statistical inference; probability distributions, hypothesis testing, estimation, with emphasis on applications to sample data from experiments and surveys. Graduate Staff

ST 514 Experimental Statistics for Social Sciences II. *Preq.: ST 513 or equivalent. 3(3-0) S.* Extension of basic statistical concepts to computer handling of data from social surveys; sample designs using clustered, stratified, systematic and multi-stage selections; analysis of variance continued; multiple, multivariate regression. Proctor

ST 515, 516 Experimental Statistics for Engineers. *Preq.: (515) ST 361 or grad. standing; (516) ST 515. 3(3-0) F,S.* General statistical concepts and techniques useful to research workers in engineering, textiles, wood technology, etc. Probability distributions, measurement of precision, simple and multiple regression, tests of significance, analysis of variance, enumeration data and experimental designs. Manson

ST 517 Applied Least Squares. *Preq.: ST 402 or equivalent. 3(3-0) F.* Least squares estimation and hypothesis testing procedures for linear models. Regression, analysis of variance and covariance is considered in a unified manner that requires no extensive mathematical background. Emphasis is on the use of the computer to apply these techniques to experimental (including unequal cell sizes) and survey situations. Rawlings

ST 518 Applied Time Series Analysis. *Preq.: ST 512. 3(3-0) F.* An introduction to the use of statistical methods for analyzing and forecasting data observed over time. Trigonometric regression, periodogram/spectral analysis. Smoothing. Autoregressive moving average models. Regression with autocorrelated errors. Linear filters and bivariate spectral analysis. Methods and applications stressed; software implementations described and used in assignments. Bloomfield, Dickey, Pantula

ST 519 Applied Multivariate Statistical Analysis. *Preq.: ST 512 or equivalent. 3(3-0) S.* An introduction to the use of multivariate statistical methods in the analysis of data collected in experiments and surveys. Topics covered will include multivariate analysis of variance, discriminant analysis, canonical correlation analysis and principal components analysis. The use of a computer to perform the multivariate statistical analysis calculations will be emphasized. Gerig, Monahan

ST 521 Statistical Theory I. *Coreqs.: MA 425 or MA 511 and MA 405. 3(2-2) F.* Discussion of the use of statistics as illustrated by an example pointing out the need for a probabilistic framework. The probability tools for statistics: description of discrete and absolutely continuous distributions, expected values, moments, moment generating functions, transformation of random variables, marginal and conditional distributions, independence, order statistics, multivariate distributions, concept of random sample, derivation of many sampling distributions. Bhattacharyya, Boos

ST 522 Statistical Theory II. *Preq.: ST 521; Coreq.: MA 426 or MA 512. 3(2-2) S.* General framework for statistical inference. Point estimators: biased and unbiased, minimum variance unbiased, least mean square error, maximum likelihood and least squares, asymptotic properties. Interval estimators and tests of hypotheses: confidence intervals, power functions, Neyman-Pearson lemma, likelihood ratio tests, unbiasedness, efficiency and sufficiency. Bhattacharyya, Boos

ST 531 Design of Experiments. *Preq.: ST 402 or equivalent. 3(3-0) F.* Review of completely randomized, randomized complete block and Latin square designs and the basic concepts in the techniques of experimental design. Designs and analysis methods in factorial experiments, confounded factorials, response surface methodology, change-over design, split-plot experiments and incomplete block designs. Examples will be used to illustrate application and analysis of these designs. Giesbrecht

ST 532 Introduction to Survey Sampling. *Preq.: MA 214 or ST 311 or equivalent. 3(3-0) S.* Description of the principal steps in the planning and execution of sample surveys. Review of actual surveys in various fields. Basic concepts of sampling and sampling methods. Practice in evaluating and designing sample surveys. Proctor, Wasik

ST (MA) 541 Theory of Probability I. *3(3-0) F, Sum.* (See mathematics.)

ST (MA) 542 Introduction to Stochastic Processes. *Preqs.: MA 405 and MA 541 or ST 521. 3(3-0) S.* Markov chains and Markov processes, Poisson process, birth and death processes, queuing theory, renewal theory, stationary processes, Brownian motion. Bhattacharyya, Wesler

ST (EB) 561 Intermediate Econometrics. *3(3-0) S.* (See economics and business.)

ST (TOX) 563 Statistical Problems in Toxicology. *Preq.: ST 511 or equivalent. 2(2-0) S. Alt. yrs.* Introduction to statistical issues arising in toxicological research, including review of standard statistical techniques. Special topics include teratological and short-term mutagenicity studies, long-term cancer bioassays, epidemiology, risk assessment and the use of historical controls. Brownie

ST (BMA, MA) 571 Biomathematics I. 3(3-0) F. (See biomathematics.)

ST (BMA, MA) 572 Biomathematics II. 3(3-0) S. (See biomathematics.)

ST 581 Introduction to Nonparametric Statistics. *Preq.: ST 522. 3(3-0) S. Alt. yrs.* This course will treat both theoretical and methodological material relevant to inference problems arising when sampling is from a parent family with distribution function that is not assumed to have a particular functional form. Most of the course will be devoted to inference problems for the absolutely continuous family of distributions. Boos

ST 583 Introduction to Statistical Decision Theory. *Preq.: ST 522. 3(3-0) F. Alt. yrs.* Zero sum two-person games and statistical inference. Bayesian methods and orthodox statistical estimation and testing; minimax decision rules; empirical Bayes procedures; Bayes sequential decision procedures. Berger, Bhattacharyya, Monahan

ST 591 Special Problems. *Preq.: CI. 1-3 F,S,Sum.* Development of techniques for specialized cases, particularly in connection with thesis and practical consulting problems. Graduate Staff

ST 595 Statistical Consulting. *Preqs.: ST 512 and ST 522. 1(1-1) F,S,Sum.* Participation in regularly scheduled supervised statistical consulting sessions with faculty member and client. Consultant's report written for each session. Regularly scheduled meetings with course instructor and other student consultants to present and discuss consulting experiences.

FOR GRADUATES ONLY

ST (MA, OR) 606 Nonlinear Programming. *Preqs.: OR (IE, MA) 505 and MA 425 or equivalent. 3(3-0) F.* This course provides an advanced mathematical treatment of the analytical and algorithmic aspects of finite dimensional nonlinear programming. It includes an examination of the structure and effectiveness of computational methods for unconstrained and constrained minimization. Special attention will be directed toward current research and recent developments in the field. Peterson, Reiland

ST 613 Time Series Analysis: Time Domain. *Preqs.: ST 512 and ST 522. 3(3-0) S. Alt. yrs.* Estimation inference for coefficients in autoregressive, moving average and mixed models and large sample. Distribution theory for autocovariances and their use in identification of time series models. Stationarity and seasonality. Extensions of theory and methods to multiple series including vector autoregressions, transfer function models, regression with time series errors, state space modeling. Dickey, Pantula

ST 614 Time Series Analysis: Frequency Domain. *Preqs.: ST 512 and ST 522. 3(3-0) S. Alt. yrs.* Theory and methods of time series analysis from the frequency point of view. Harmonic analysis, complex demodulation and spectrum estimation. Frequency domain structure of stationary time series and space-time processes. Sampling distributions of commonly used statistics. Bloomfield

ST (MA) 617, 618 Measure Theory and Advanced Probability. *Preqs.: (617) MA 426; ST 521 or MA 541 or equivalent; (618) ST 617. 3(3-0) F.* Modern measure and integration theory in abstract spaces. Probability measures, random variables, expectations. Distributions and characteristic functions. Modes of convergence. Independence, zero-one laws, laws of large numbers, three-series theorem. Central limit problem. Conditional expectations, martingales and martingale convergence theorems. Bhattacharyya, Wesler

ST (MA) 619 Topics in Advanced Probability. *Preq.: ST (MA) 618. 3(3-0).* Infinitely divisible distributions and stable laws. Stationarity, ergodic theorems. Markov chains. Weak convergence of probability measures on metric spaces, Brownian motion, invariance principles, law of the iterated logarithm. Wesler

ST 621 Statistics in Animal Science. *Preq.: ST 517 (ST 402 for statistics majors). 3(3-0).* Sources and magnitudes of errors in experiments with animals, experimental designs and computer methods of analysis adapted to specific types of animal research; relative efficiency of alternate designs, amount of data required for specified accuracy, student reports of selected topics. Linnerud

ST 623 Statistics in Plant Science. *Preq.: ST 512 or equivalent. 3(3-0) F.* Principles and techniques of planning, establishing and executing field and greenhouse experiments. Size, shape and orientation of plots; border effects; estimation of size of experiments for specified accuracy; subsampling plots and yields for laboratory analysis; combining data from a series of years and/or locations; rotation experiments; soil test correlation; multiple comparisons in variety trial results; selection of predictors in multiple regression; introduction to interspecies and intraspecies plant competition experiments and models. Nelson

ST (GN) 626 Statistical Concepts in Genetics. *Preq.: GN 506; Coreq.: ST 402 or equivalent. 3(3-0) S. Alt. yrs.* Migration, mutation, selection, drift, linkage, mating system and other processes that bear on rates of change in population frequencies, means and variances; magnitude and nature of genotypic and nongenotypic variability and their role in alternative procedures of plant and animal breeding; experimental and statistical approaches to the analysis of quantitative inheritance. Cockerham

ST 631 Theory of Sampling Applied to Survey Design. *Preqs.: MA 214 or equivalent; ST 402 or equivalent. 3(3-0) F.* Principles for interpretation and design of sample surveys. Estimator biases, variances and comparative costs. Simple random sample, cluster sample, ratio estimation, stratification, varying probabilities of selection. Multi-stage, systematic and double sampling. Response errors. Proctor

ST 637 Advanced Statistical Inference. *Preqs.: ST 522, ST 617. 3(3-0) S.* This course will treat the classical areas of statistical inference, estimation and hypothesis testing, at the measure-theoretical level. Emphasis will be upon treatment of these areas in depth. van der Vaart

ST 645 Statistical Computing. *Preq.: ST 681. 3(3-0) F.* The intent of the course is to provide the statistician with the computational tools for statistical research and applications using digital computing machinery. Topics to be covered include random number generation and Monte Carlo methods, regression computations and application to statistical methods of optimization, sorting and Fast Fourier transform. Monahan

ST (EB) 651 Econometrics. *3(3-0) F.* (See economics and business.)

ST (EB) 652 Topics in Econometrics. *3(3-0) S.* (See economics and business.)

ST 671 Advanced Analysis of Variance and Variance Components. *Preqs.: ST 402 or equivalent, ST 681. 3(3-0) S. Alt. yrs.* Expected mean squares, exact and approximate tests of hypotheses for balanced and unbalanced data sets. Fixed, mixed and random models. Ran-

domization theory. Estimation of variance components using regression, MINQUE and general quadratic unbiased estimation theory. Giesbrecht

ST 674 Advanced Topics in Construction and Analysis of Experimental Designs. *Preqs.: ST 402 or equivalent, ST 681. 3(3-0).* Construction and analysis of multifactor designs, factorials, fractional factorials, balanced incomplete block designs, Latin squares, orthogonal arrays of strength d and response surface designs. Fractionating mixed level factorials, confounding and blocking techniques, study of robustness of designs to loss of design point. Manson

ST 681 Linear Models and Variance Components. *Preqs.: MA 405, ST 521; Coreq.: ST 522. 3(2-2) S.* Theory of estimation and testing in full and non-full rank linear models. Normal theory distributional properties. Least squares principle and the Gauss-Markoff theorem. Estimability and properties of best linear unbiased estimators. The general linear hypothesis. Application of dummy variable methods to elementary classification models for balanced and unbalanced data. Analysis of covariance. Variance components estimation for balanced data. Swallow

ST 682 Statistical Analysis for Linear Models. *Preqs.: ST 402 or equivalent, ST 681. 3(3-0) F.* Theory and analysis of the general linear model including models with equality and inequality constraints, with possibly singular covariance structure and with multivariate responses. Canonical decompositions and optimality properties of standard methods. Applications to certain designs and growth curve analysis. Robust regression techniques. Strategic transformation of data. Gallant

ST 683 Multivariate Analysis. *Preqs.: ST 522 and ST 682. 3(3-0) S. Alt. yrs.* Survey of multivariate statistical theory. Multivariate distributions including the multinormal, Wishart, Hotelling's T^2 , Fisher-Roy-Hsu, Wilks' V and multivariate Beta distributions. Applications of maximum likelihood estimation, likelihood ratio testing and the union-intersection principle. Development of the theory of Hotelling's T^2 tests and confidence sets, discriminant analysis, canonical correlation, multivariate analysis of variance and principal components. Gerig, Monahan

ST 691 Advanced Special Problems. *Preqs.: ST 402 or equivalent, ST 681. 1-3 F,S,Sum.* Any new advance in the field of statistics which can be presented in lecture series as unique opportunities arise. Graduate Staff, Visiting Professors

ST 694 Seminar. *1(1-0) F,S.* Graduate Staff

ST 699 Research. *Credits Arranged. F,S,Sum.* Graduate Staff

Textiles

GRADUATE FACULTY

Professor D. S. Hamby, Dean

Professors: S. K. Batra, G. A. Berkstresser—Head of the Department of Textile Management and Technology, D. R. Buchanan, D. M. Cates J. A. Cuculo, A. H. M. El-Shiekh, T. W. George, R. D. Gilbert, P. L. Grady—Associate Dean, B. S. Gupta—Assistant Head and Graduate Administrator of the Department of Textile Engineering and Science, S. P. Hersh—Head of the Department of Textile Engineering and Science, C. D. Livengood—Head of the Department of Textile Chemistry, P. R. Lord, R. McGregor, M. H. M. Mohamed—Assistant Dean for

Academic Programs, A. B. Moss, W. C. Stuckey Jr., M. H. Theil, C. Tomasino, P. A. Tucker—*Graduate Administrator of the Department of Textile Management and Technology*, W. K. Walsh—*Associate Dean and Graduate Administrator in Fiber and Polymer Science*; *Adjunct Professors*: F. I. Carroll, J. E. Hendrix, T. Iijima, H. F. Mark, M. W. Suh, A. A. Volpe; *Professors Emeriti*: J. F. Bogdan, K. S. Campbell, D. W. Chaney, P. D. Emerson, J. A. Porter Jr., H. A. Rutherford, M. R. Shaw, W. M. Whaley, R. W. Work; *Associate Professors*: R. L. Barker, R. A. Donaldson, H. S. Freeman P. B. Hudson, T. J. Little, G. N. Mock—*Assistant Head and Graduate Administrator of the Department of Textile Chemistry*, M. L. Robinson Jr.—*Assistant Head of the Department of Textile Management and Technology*, C. B. Smith; *Visiting Associate Professors*: E. M. McPherson, R. I. Riley; *Adjunct Associate Professors*: J. W. Coryell, D. M. Powell, P. E. Sasser; *Associate Professors Emeriti*: T. H. Guion, A. C. Hayes, T. G. Rochow; *Assistant Professors*: A. C. Clapp, G. W. Smith

The School of Textiles offers programs leading to the Master of Science degree in the Departments of Textile Chemistry, Textile Engineering and Science, and Textile Management and Technology, Materials and Management, the professional degree of Master of Textiles and the Doctor of Philosophy in fiber and polymer science. (See fiber and polymer science for a description of the program.) The School of Textiles also participates in the Master of Science in management program in which students combine studies in the Department of Economics and Business with courses from the Department of Textile Management and Technology (see management).

Students otherwise meeting the requirements of the Graduate School and with Bachelor of Science degrees with majors in textiles, the physical sciences or engineering will normally qualify for the graduate degree programs.

The minimum requirement for a Master of Textiles degree is the satisfactory completion of 33 semester hours of advanced courses. There is no thesis or foreign language requirement. This program offers the student advanced professional training with emphasis on management, quality or manufacturing control, technology, machine design or textile design.

The programs of study for the Master of Science degree include a minimum of 30 semester hours of advanced courses, including six semester hours devoted to a thesis based on research conducted by the student. There is no foreign language requirement. The plan of course work and the research activities for the Master of Science degree are designed to prepare the student for a career in research, development, management or other technical phases of the textile and allied industries. Students may minor in one or more of a number of associated fields.

Programs of study may be arranged to develop a broad background in three general areas: advanced textile materials science, production and marketing management of textiles and textile chemistry. Those students interested in the first of these may emphasize areas such as fiber and yarn processing operations, mechanical and physical properties of fibers and textile structures and testing or quality control. Programs leading to the Master of Science degree in textile chemistry emphasize fiber and polymer chemistry in its own right and as a basis

for dyeing and finishing treatments for textile materials. In the area of marketing and production management, the program emphasizes the applications of quantitative decision-making methods, including operations research and computer techniques, to the textile industry. Programs in this area normally terminate within the School of Textiles with a master's degree but may be structured to provide suitable backgrounds for students wishing to do further graduate work in the areas of economics and business, industrial management, industrial engineering or business administration.

Fiber and Polymer Science

See fiber and polymer science for a list of associated courses.

Textiles (General Courses)

SELECTED ADVANCED UNDERGRADUATE COURSES

T 401 Environmental Aspects of the Textile Industry. *Preq.: Sr. standing. 3(3-0) S.*

T 402 Introduction to the Theory and Practice of Fiber Formation. *Preqs.: CH 103, T 203, MA 212, PY 212. 3(3-0) S.*

T 491H Honors Seminar in Textiles. *By invitation into Honors Program in Textiles. 1(1-0) F,S.*

T 493 Industrial Internship in Textiles. *Preq.: Textile core courses. 3 F,S,Sum.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

T 500 Fiber and Polymer Microscopy. *Preqs.: MA 212, PY 212, T 203. 3(1-4) F.* The art and science of light and electron microscopy; theoretical and practical aspects of visibility, resolution and contrast. Laboratory practice in assembling, testing and using various microscopes and accessories in analyzing, describing and identifying unoriented and oriented crystalline or amorphous materials. Laboratory emphasis is on the study of fibers and polymers through transmission microscopy with polarized light. Tucker

T 506 Color Science. *Preq.: Sr. in TC or grad. standing. 3(2-2) F.* A thorough discussion of color theory with particular emphasis on color measurement. Color and color difference calculations. From the data of the basic color matching experiments, the description of a color space and its transformation into the CIE color space will be followed in detail. The basis of color difference calculations will be discussed. Color matches and color differences will be calculated based on experimental data obtained in the course. McGregor

Textile Chemistry

For a listing of graduate faculty and other information, see textiles.

SELECTED ADVANCED UNDERGRADUATE COURSES

TC 405 Chemical and Physical Evaluation of Textiles. *Preqs.: T 250, TC 320 and TC 330 or T 301. 3(2-3) F.*

TC 406 Textile Chemical Technology Laboratory. *Preqs.: TC 320, 330 and sr. standing. 2(0-6) S.*

TC 412 Textile Chemical Analysis II. *Preq.: T 203. 3(2-3) S.*

TC 415 Principles and Practice of Textile Printing. *Preqs.: T 301 or TC 320 or PD(TX) 272. 3(2-2) F.*

TC 441 Theory of Physico-Chemical Processes in Textiles I. *Preqs.: MA 301 or 212, PY 205 or 211. 3(2-2) F.*

TC 442 Theory of Physico-Chemical Processes in Textiles II. *Preq.: TC 441. 3(2-2) S.*

TC 451 Computers in Textile Wet Processing. *Preqs.: MA 212, PY 212, T 301. 3(3-0) S.*

TC (CH) 461 Introduction to Fiber-Forming Polymers. *Preq.: CH 223. 3(3-0) F.*

TC 490 Special Topics in Textile Chemistry. 1-6 F,S.

TC 491 Seminar in Textile Chemistry. *Preqs.: TC 320, TC 330 and sr. standing. 1(0-2) S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

TC 504 Fiber Formation—Theory and Practice. *Preqs.: MA 301, PY 208 or CI. 3(3-0) F.* Practical and theoretical analysis of the chemical and physical principles underlying the conventional methods of converting bulk polymer to fiber; rheology; melt, dry and wet polymer extrusion; fiber drawing; heat setting; general theory applied to unit processes. Cuculo

TC 505 Theory of Dyeing. *Preq.: CH 433 or CI. 3(3-0) S.* Mechanisms of dyeing. Application of thermodynamics to dyeing systems. Kinetics of diffusion in dyeing processes. McGregor

TC 520 Chemistry of Dyes and Color. *Preqs.: CH 221 and CH 223. 3(3-0) S.* Correlation of color and chemical constitution, synthetic routes for popular dyes of all important types; electronic mechanisms for reactive dyes; chemistry of dye interactions with light, washing and other in-use influences; economic and environmental considerations. Freeman

TC 521 Dye Synthesis Laboratory. *Preq.: TC 520. 3(0-9) F.* Laboratory work in the preparation and analysis of synthetic dyes of a large number of types. Personal instruction in techniques and processes for preparation and purification of intermediates and dyes. Freeman

TC 530 The Chemistry of Textile Auxiliaries. *Preq.: One year of organic chemistry. 3(3-0) F.* Industrially important textile chemicals used for enhancing fiber and fabric properties such as durable press, water repellency, antisoiling, flame retardancy, softness, stiffness, lubricity and other uses will be studied. Correlation of effect with structure, end-use influences, interaction with fabric and fibers, sources and synthetic routes, economic and environmental considerations will be covered. Tomasino

TC 561 Organic Chemistry of High Polymers. *Preqs.: TC (CH) 461, CH 331 or CH 431. 3(3-0) S.* Principles of step- and chain-growth polymerizations; copolymerization theory;

homogeneous free radical polymerization; emulsion polymerization; Ziegler-Natta polymerization; ionic polymerization. Gilbert, Theil

TC (CH) 562 Physical Chemistry of High Polymers—Bulk Properties. *Preqs.: CH 220 or 223, CH 331 or 431. 3(3-0) F.* Molecular weight; states of aggregation and their interconversion; rubbery, glassy and crystalline states; rubber elasticity; molecular friction; diffusion and viscosity; dynamics of network response; retardation- and relaxation-time spectra; thermodynamics of nucleation; kinetics of crystallization. Cates

TC (CHE) 569 Polymers, Surfactants and Colloidal Materials. *3(3-0) F.* (See chemical engineering.)

TC (CHE) 570 Radiation Chemistry and Technology of Polymeric Systems. *3(3-0) S.* (See chemical engineering.)

TC 591 Special Topics in Textile Science. *Preqs.: Sr. or grad. standing and CI. 1-4 F,S.* Intensive treatments of selected topics in textile, polymer and fiber science. Graduate Staff

FOR GRADUATES ONLY

TC 662 Physical Chemistry of High Polymers—Solution Properties. *Preqs.: CH 433, TC (CH) 562. 3(3-0) S.* Sorption and diffusion; thermodynamics of polymer solutions; phase equilibria; configurational and frictional properties; determination of molecular weight. Theil

TC (CHE) 669 Diffusion in Polymers. *2(2-0) S.* (See chemical engineering.)

TC (CHE) 671 Special Topics in Polymer Science. *1-3 F.* (See chemical engineering.)

TC (TX) 691 Special Topics in Fiber Science. *1-3 S.* (See textile engineering and science/textile management and technology.)

TC 698 Seminar for Textile Chemistry. *1(1-0) F,S.* Discussion of scientific articles and presentations; review and discussion of student papers and research problems. Graduate Staff

TC 699 Textile Research for Textile Chemistry. *Credits Arranged.* Individual research in the field of textile chemistry. Graduate Staff

Textile Engineering and Science/Textile Management and Technology

For a listing of graduate faculty and other information, see textiles.

SELECTED ADVANCED UNDERGRADUATE COURSES

TE 403 Mechanics of Fibrous Structures. *TE 201, MA 301, MAE 314 or CE 313. 3(3-0) F.*

TX 405 Contemporary Nonwoven Textiles. *Preqs.: TX 305, sr. standing and CI. 3(1-4) S.*

TX 420 Modern Developments in Yarn Manufacturing. *Preq.: Sr. standing. 3(3-0) S.*

TX 425 Textured Yarn Production and Properties. *Preqs.: T 211, T 220, PY 211 (205); Coreq.: PY 212 (208). 3(2-2) F.*

- TX 431 Fabric Performance Testing.** *Preqs.: TX 330, sr. standing. 3(2-2) F.*
- TX 442 Advanced Knitted Fabric Design.** *Preq.: TX 370. 3(2-2) S.*
- TX 443 Analysis of Knitting Systems and Fabric Properties.** *Preq.: TX 341. 3(3-0) F.*
- TX 450 Advanced Weaving.** *Preq.: TX 351. 3(2-2) F.*
- TX 451 Advanced Woven Fabric Design.** *Preq.: TX 370. 3(2-2) Alt. F.*
- TX 460 Physical Properties of Textile Fibers.** *Preqs.: MA 212, PY 212. 3(3-0) F,S.*
- TX 461 Mechanical Properties of Fibrous Structures.** *Preqs.: MA 301, TX 460. 3(3-0) S.*
- TX (PD) 472 Textile Design Internship.** *Preqs.: PD (TX) 272, 371 and 372. 3 Sum.*
- TX 480 Textile Production and Cost Control.** *Preqs.: TX 380, EB 301, ACC 265 or 260, sr. standing. 3(3-0) F,S.*
- TX (EB) 482 Textile Marketing Management.** *Preqs.: EB 313, EB 301, TX 380. 3(2-2) F,S.*
- TX 484 Management Decision Making for the Textile Firm.** *Preqs.: TX 480, EB 302; Coreq.: TX 482. 3(3-0) F,S.*
- TX 487 Textile Labor Management.** *Preq.: Sr. standing. 3(3-0) F,S.*
- TX 490 Development Project in Textile Technology.** *Preqs.: Sr. standing and 2.75 GPA. 2-3 F,S,Sum.*
- TX 491 Special Topics in Textiles.** *Preq.: Sr. standing. 1-3 F,S.*
- TX 495 Senior Seminar in Textile Materials and Management.** *Preqs.: Sr. standing and CI. 1(1-0) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

- TX 505 Textile Instrumentation and Control Systems.** *Preqs.: MA 301, PY 212 and one course in computer science. 3(3-0) F.* The theory and application of instruments and control systems used in modern textile plants. Basic instruments and computer systems are described along with their use in process control, production control, research and development.
Grady
- TX 520 Yarn Processing Dynamics.** *Preqs.: MA 301 and CI or grad. standing. 3(2-2) F.* Theoretical analysis of the dynamics and machine-fiber interactions of such functions as opening, cleaning, carding actions, fiber attenuation, ring spinning, open-end spinning, texturing and winding. The role of fiber placement, cohesion and lubrication on yarn processing and properties. Laboratory experiments are designed to verify the analysis discussed in the lectures.
El-Shiekh
- TX 530 Textile Quality Control.** *Preq.: TX 330 or CI. 3(3-0) S.* Quality control systems for textile operations with emphasis on sampling plans for attributes and variables and on interpretation of data as related to identifying sources of product variability.
Stuckey
- TX 541 Theory and Practice of Knitted Fabric Production and Control.** *Preqs.: TX 370 and CI. 3(3-0) F.* The technology and control systems for manufacturing simple and complex knitted fabrics; control and monitoring of yarn feeding systems; influence of yarn, machine, finishing and fabric structure on the fabric aesthetics, physical and mechanical properties;

optimization of fabric properties and machine productivity, including costing; problems of jacquard fabric processing and control.
Graduate Staff

TX 549 Warp Knit Engineering and Structural Design. *Preq.: TX 443. 3(3-0) S.* Engineering analysis of tricot and raschel machinery. Design of yarn let-off and fabric take-up mechanisms. Studies of fabric production techniques and quality control systems. Theory of production optimization and the properties of fabrics. Complex geometrical loop models and their application.
Graduate Staff

TX 555 Production Mechanics and Properties of Woven Fabrics. *Preqs.: MA 301 and CI or grad. standing. 3(2-2) S.* The interrelations between the mechanics of production and mechanical properties of woven fabrics; unit operations required to prepare yarns for weaving and the mechanisms employed in weaving; fabric structure, geometry and mechanical properties; designing for specific fabric properties.
Mohamed

TX 561 Mechanical and Rheological Properties of Fibrous Material. *Preq.: MA 301. 3(2-2) S.* In-depth study of the stress-strain, bending, torsional, dynamic and rheological behavior of natural and man-made fibers. Theoretical relations and advanced techniques are presented and discussed.
Gupta, Hersh

TX 562 Physical Properties of Fiber Forming Polymers, Fibers and Fibrous Structures. *Preqs.: MA 301, PY 208. 3(3-0) F.* Experimental results and theoretical considerations of the physical properties of fibers and fiber forming polymers will be discussed. This will include electrical, thermal, optical, frictional and moisture properties of these materials. The influence of chemical and molecular fine structure on these properties will be discussed.
Buchanan, Gupta

TX 563 Characterization of Structure of Fiber Forming Polymers. *Preqs.: MA 301, PY 208. 3(3-0) F.* Theories, experimental evidence and characterization methods of the molecular fine structure of fiber forming polymers in the solid state will be discussed. Characterization methods will include X-ray diffraction, microscopy, infrared, thermal and magnetic resonance. An introduction to nucleation theory of polymer systems will be presented.
Buchanan, Gupta

TX (EB) 585 Market Research in Textiles. *Preq.: TX (EB) 482. 3(3-0) S.* A study and analysis of the quantitative methods employed in market research in the textile industry. The function of market research and its proper orientation to management and decision making.
Berkstresser

TX 590 Special Projects in Textiles. *Preqs.: Sr. standing or grad. standing, CI. 2-3 F,S,Sum.* Special studies in either the major or minor field of the advanced undergraduate or graduate student. These studies will include current problems of the industry, independent investigations, seminars and technical presentations, both oral and written.
Graduate Staff

TX 591 Special Topics. *Preq.: CI. 1-4 F,S.* An intensive treatment of selected topics involving textile technology.
Graduate Staff

TX 598 Textile Technology Seminar. *Preqs.: Sr. standing, CI. 2(2-0) S.* Lecture and discussion of current topics relating to the textile industry.
Graduate Staff

FOR GRADUATES ONLY

TX 603 Group Research in Textiles. *Preqs.: TX 520 and TX 555 or TX 541. 3(2-3) F.* Group research under supervision in which each student will execute a portion of the research and will report to the whole group. Each student will be required to write a report on the whole project. There will be formal lectures on methodology, interpretation and application of research.
Lord

TX 621 Advanced Textile Testing. *Preqs.: TX 530; ST 421 or CI. 3(2-2) S.* Design of textile laboratories required for specific needs; experimental design and performance of tests; analysis of data relating to industrial problems; specialized physical tests; interlaboratory correlations; development of standardized test methods. Stuckey

TX 631 Synthetic Fibers. *Preq.: TX 425 or equivalent. 2(1-2) F,S,Sum.* Lectures and projects on advanced problems associated with the properties and processing of man-made continuous filament and staple fiber yarns. Hersh

TX 640 Physical and Mechanical Properties of Knitted Fabric. *Preq.: TX 541. 3(3-0) Alt.* S. Seminar discussions of research literature on studies of the physical and mechanical properties of knitted fabrics. Graduate Staff

TX 651, 652 Fabric Development and Construction. *Preq.: Grad. standing. 3(1-4) F,S.* Application of advanced technology to the development and construction of woven fabrics. Graduate Staff

TX 663 Mechanics of Twisted Structures. *Preq.: TX 561 or equivalent. 3(3-0) F.* Study of the basic mechanics of fibrous assemblies. Geometry and mechanics of twisted structures (yarns, cords, braids, etc.) and the translation of fiber properties into structural behavior. Batra, El-Shiekh

TX 664 Mechanics of Fabric Structures. *Preq.: TX 561 or equivalent. 3(3-0) S.* Analysis of the geometry and behavior of woven, knitted and nonwoven fabrics under various stress conditions and end use applications. Batra, El-Shiekh

TX 680 Special Projects in Textile Management. *Preq.: TX (EB) 585. 13 F,S,Sum.* Special studies in textile management covering current problems of the industry, independent investigations, seminars and technical presentations, both oral and written. Graduate Staff

TX 686 Advanced Textile Labor Management Seminar. *Preq.: TX 487 or CI. 3(3-0) F,S.* A study of advanced labor management problems in the textile industry, with particular emphasis directed toward the application of the Occupational Safety and Health Act. Powell

TX 687 Competitive Strategy and Planning for the Textile Firm. *Preq.: Completion of 18 credit hours in a graduate degree program, of which at least 6 hours must be in economics and related courses at the 500 level or higher. 3(3-0). F.* Elements of competitive strategy and planning methods within the textile complex with emphasis on the concepts of strategy in a mature industry, defining business in a global industry, resource allocation through strategic planning methods and implementing strategy in single business and multi-business firms. Moss

TX (TC) 691 Special Topics in Fiber Science. *Preq.: CI. 1-3 S.* The study of selected topics of particular interest in various advanced phases of fiber science. Graduate Staff

TX 697 Independent Study in Textiles. *3(3-0) F,S,Sum.* Problems of specific interest in textiles will be assigned for study and investigation. The preparation of a report for publication will be required. Three hours maximum credit will be allowed toward Master of Textiles degree. No credit is allowed toward Master of Science in Textiles degree. Graduate Staff

TX 698 Seminar. *1(1-0) F,S.* Discussion of scientific articles of interest to the textile industry; review and discussion of student papers and research problems. Graduate Staff

TX 699 Textile Thesis or Dissertation Research. *Credits Arranged. F,S,Sum.* Problems of specific interest to the textile industry will be assigned for study and investigation. The use of experimental methods will be emphasized. Attention will be given to the preparation of reports for publication. The master's thesis may be based upon the data obtained.

Graduate Staff

Toxicology

GRADUATE FACULTY

Professor E. Hodgson, Chairman

Professors: A. L. Aronson, G. T. Barthalmus, W. C. Dauterman, W. E. Donaldson, F. E. Guthrie, P. B. Hamilton, R. J. Kuhr, A. R. Main, J. J. Perry, T. J. Sheets; *Professors (USDA):* W. W. Heck, D. E. Moreland; *Adjunct Professors:* J. R. Bend, J. R. Fouts, R. A. Neal, R. M. Philpot; *Professors Emeriti:* D. S. Grosch, D. W. Hayne, R. J. Monroe; *Associate Professors:* H. M. Hassan, W. H. McKenzie, J. E. Riviere; *Adjunct Associate Professors:* N. Chernoff, T. E. Eling, H. B. Matthews Jr.

Graduate study under the direction of the toxicology faculty may lead to the Master of Toxicology, Master of Science and the Doctor of Philosophy degrees. The toxicology faculty is an interdisciplinary group drawn from the following areas: biochemistry, botany, crop science, food science, genetics, entomology, microbiology, poultry science, statistics, veterinary medicine and zoology. The student will be associated with one of the above programs and conduct his research in the laboratories of his chairman or co-chairman.

The degree program is cooperative with the University of North Carolina at Chapel Hill and students may take courses at either university as well as selected courses at Duke University. A core of 6 courses taught from offerings of these three universities is a minimal requirement for the Ph.D. degree. Students are expected to take additional courses necessary for a strong background in toxicology. Minors may be chosen from a wide range of programs including biochemistry, biotechnology, botany, entomology, epidemiology, genetics, microbiology, nutrition, pharmacology, physiology, statistics and zoology.

The program is also closely associated with major research organizations in the nearby Research Triangle Park, including the National Institute of Environmental Health Sciences, Environmental Protection Agency, Chemical Industry Institute of Toxicology and Burroughs Wellcome Foundation. These laboratories, plus the universities, offer an unusual range of research projects and facilities.

Prerequisites for admission include a strong background in biology and physical sciences. The Aptitude Test of the Graduate Record Examination is required and the Advanced Test in biology or chemistry is desirable.

Financial assistance for qualified students in the form of traineeships, fellowships and research assistantships is available through participating departments. Prospective students may obtain further information by writing to any of the graduate faculty listed above or to the Chairman, Toxicology Program, Box 7633, N. C. State University, Raleigh, N. C. 27695-7633.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

TOX 510 Biochemical Toxicology. *Preqs.: Biochemistry, sr. standing. 3(3-0) S.* Emphasis is placed on the molecular events that occur during the toxic action of xenobiotics, including penetration phenomena, mechanisms involved in detoxication, and the mechanisms of action at the target site.

TOX 515 Environmental Toxicology. *Preq.: Two years of biology. 3(3-0) F.* The nature, distribution and significance of microchemical contamination will be evaluated. Emphasis will be placed on current, relevant problems.

TOX (ST) 563 Statistical Problems in Toxicology. *2(2-0) S. Alt. yrs. (See statistics.)*

TOX 590 Special Problems in Toxicology. *Preq.: Grad. standing. 1-3.*

FOR GRADUATES ONLY

TOX 690 Toxicology Seminar. *Preq.: Grad. standing. 1(1-0) S.*

TOX 699 Research. *Preq.: Grad. standing. Credits Arranged. F,S.* Original research in connection with thesis problem in toxicology.

COURSES FROM ASSOCIATED DEPARTMENTS

BCH 551 General Biochemistry I

BCH 652 Biochemical Research Techniques

CH 428 Qualitative Organic Chemistry

ENT 622 Insect Toxicology

VMS 531 Mammalian Neuroanatomy

VMS 540 Research Animal Care and Use

VMS 553 Veterinry Immunology

VMS 560 Introductory Pharmacology

VMS 562 Systemic Pharmacology and Toxicology

VMS 563 Systemic Pharmacology and Toxicology Laboratory

VMS 690B Special Topics in Pathology

VMS 696A Seminar in Pharmacology

ZO 614 Advanced Cell Biology

SELECTED COURSES AT UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

PHARM 216 Introductory Pharmacology

EPID 162 Epidemiology

SELECTED COURSE AT DUKE UNIVERSITY

PATH 382 Toxicological Pathology

Urban Design

For a listing of graduate faculty and departmental information, see architecture.

Veterinary Medical Sciences

GRADUATE FACULTY

Professor C. E. Stevens, Coordinator

Professors: W. M. Adams, R. A. Argenzio, A. L. Aronson, H. J. Barnes, P. J. Bentley, H. A. Berkhoff, C. W. Betts, T. T. Brown Jr., P. B. Carter, L. Coggins, S. W. Crane, T. M. Curtin, R. C. Dillman, B. D. Harrington, D. R. Howard, C. W. McPherson, D. J. Moncol, W. D. Oxender, M. C. Roberts, D. G. Simmons, J. E. Smallwood, C.-S. Teng, D. E. Thrall; *Adjunct Professor:* F. Welsch; *Professor Emeritus:* E. G. Batte; *Associate Professors:* E. B. Breitschwerdt, W. T. Corbett, E. V. De Buysscher, J. R. Easley, J. P. Fetrow, R. B. Ford, B. A. Gilroy, B. Hammerberg, M. S. Hand, H. D. Hilley, J. N. Kornegay, M. G. Levy, N. J. MacLachlan, D. J. Meuten, N. C. Olson, J. E. Riviere; *Adjunct Associate Professors:* T. E. Eling, C. T. Teng, E. W. Van Stee; *Assistant Professors:* K. L. Anderson, P. J. Armstrong, S. A. Bai, L. M. Ballas, K. F. Bowman, C. F. Browne, S. E. Bunch, J. M. Cullen, G. D. Dial, L. N. Fleisher, F. J. Fuller, J. S. Guy, C. K. Henrikson, L. C. Hudson, E. Hunt, D. H. Ley, T. O. Manning, M. R. Metcalf, R. E. Meyer, E. J. Noga, P. E. Orndorff, C. L. Robinette, V. J. Scheidt, L. P. Tate Jr., S. L. Tonkonogy, S. J. Updike, S. D. Van Camp, M. D. Whitacre; *Visiting Assistant Professors:* B. R. Grubb, M. C. McGahan, N. A. Monteiro-Riviere; *Adjunct Assistant Professor:* M. W. Dewhirst; *Electron Microscopy Director:* M. J. Dykstra

ASSOCIATE MEMBERS OF THE SCHOOL

Professor: R. F. Behlow; *Extension Professor:* J. R. Harris

Graduate study under the direction of the veterinary medical faculty may lead to the Master of Science and the Doctor of Philosophy degrees. The veterinary medical faculty is a multidisciplinary group drawn from the departments of the School of Veterinary Medicine: Anatomy, Physiological Sciences and Radiology; Microbiology, Pathology and Parasitology; Companion Animal and Special Species; and Food Animal and Equine Medicine. Students will be associated with members from the above departments and conduct their research in the laboratory of their committee chairman or co-chairman.

The program provides training in basic and applied veterinary medical research to qualified students with a baccalaureate, D.V.M. or equivalent degree. Major areas of concentration include morphology, pharmacology, pathology and veterinary microbiology and immunology. Minors may be chosen from a wide range of programs including animal science, biochemistry, genetics, nutrition, poultry science, physiology, statistics, toxicology and zoology.

Prerequisites for admission include a strong background in biological science. Verbal and quantitative tests of the Graduate Record Examination are required.

Financial assistance for qualified students in the form of graduate assistantships is available through the School of Veterinary Medicine and par-

icipating faculty. Prospective students may obtain further information by writing to one of the graduate faculty listed above or to the Coordinator, Veterinary Medical Sciences Program, School of Veterinary Medicine, North Carolina State University, 4700 Hillsborough Street, Raleigh, North Carolina, 27606.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

VMS 530 Veterinary Histology. *Preqs.: BCH 451 and CI. 3(2-4) F. Alt. yrs.* The structure of cells, tissues and organs of domestic animals is studied using light microscopy.

Henrickson

VMS 531 Mammalian Neuroanatomy. *Preqs.: VMA 811 or 812 or ZO 323 and grad. standing or CI. 3(2-2) F. Alt. yrs.* The course provides detailed information about the structure of the nervous system of nonprimate animals. Emphasis is on the dog and cat but other domestic and laboratory mammals are studied. Overviews of embryology, neurohistology and experimental techniques are included.

Hudson

VMS 532 Electron Microscopy in Veterinary Medicine. *Preq.: CI. 4(2-4) S.* The course provides an introduction to ultramicrotomy, tissue processing for electron microscopy, theory and utilization of the transmission electron microscope and scanning electron microscope, darkroom techniques and an introduction to various specialized techniques for the preparation of samples for veterinary diagnostic and research electron microscopy.

Dykstra

VMS 540 Research Animal Care and Use. *Preq.: ZO 201 or equivalent. 3(2-3) S. Alt. yrs.* The principles of the selection, care and use of animals in laboratory teaching and investigation are presented. Topics covered include the ethics of animal experimentation, selection of animal models, biology and care of laboratory animals, techniques of administration of substances and obtaining of specimens, producing surgical alterations and common laboratory animal health problems.

McCormick, McPherson

VMS 541 Laboratory Animal Diseases. *Preqs.: MB 401, VMS 540, ZO 345 and grad. standing or CI. 3(2-3) S. Alt. yrs.* The diseases of common laboratory animals are studied by discussing their etiology, epizootiology, pathogenesis and clinical signs. The diagnosis of laboratory animal diseases by clinical examination of animals and post-mortem evaluation of gross and microscopic pathologic changes within animal tissues are emphasized. Procedures for disease prevention, treatment and control are also reviewed.

McPherson, Wright

VMS 550 Veterinary Medical Virology I. *Preqs.: BCH 451, MB 401 and grad. standing. 2(2-0) S.* Basic principles of animal virology and the relationship of viruses to diseases in domestic animals are discussed.

Fuller, Simmons

VMS 551 Pathogenic Bacteriology and Mycology. *Preqs.: MB 411, grad. standing and CI. 3(2-2) F.* The lecture course covers the pathogenic bacteria and fungi important in medicine. Lectures are supplemented by laboratory exercises that provide students the opportunity to learn basic characteristics of these microorganisms and how they are isolated, cultivated and identified.

Berkhoff, Carter

VMS 552 Diagnostic Bacteriology and Mycology. *Preqs.: Grad. standing, VMM 814 or VMS 551 and CI. 3(1-8) F./S.* Principles of specimen collection, selection and use of media, culture processing and identification of bacteria and fungi important in animal disease are presented.

Berkhoff

VMS 553 Veterinary Immunology. *Preqs.: MB 501C and grad. standing. 2(2-0) F.* Basic and clinical immunology is presented. The role of the immune system in disease prevention, inflammation and autoimmune diseases is discussed. De Buyscher, Tonkonogy

VMS 554 Principles of Epidemiology. *Preq.: Grad. standing or CI. 3(2-4) F.* Principles of epidemiology related to the investigation of disease involving the agent-host-environment concepts are presented. Epidemiological techniques and experimental design are stressed. Descriptive, analytical and experimental epidemiology pertinent to disease etiology and prevention are the main focus. Corbett

VMS 560 Introductory Pharmacology. *Preqs.: BCH 451, grad. standing or CI. 5(4-1) F.* The action of drugs in animals and man including basic principles of drug disposition and pharmacokinetics is discussed. Modification of physiological processes by drugs influencing coordination by the nervous, endocrine and circulatory system is described. Fleisher

VMS 561 Instrumentation in Pharmacological Research. *Preqs.: BCH 452B or CH 315 and grad. standing or CI. 2(1-4) F.* The theory and applications of modern scientific instrumentation to the analysis of tissues, body fluids and drugs in pharmacological research are described. Appropriate aspects of the pharmacological use of spectroscopy, microscopy, chromatography, electrophoresis, radioisotope usage and centrifugation are discussed. Robinette

VMS 562 Systemic Pharmacology and Toxicology. *Preq.: VMS 560 or equivalent. 3(3-0) S. Alt. yrs.* Drug and toxicant action at the organ systems level are discussed in terms of underlying physiological mechanisms and responses. Emphasis is placed on the kidney and liver with additional consideration given to the respiratory, reproductive, gastrointestinal, hematologic and immune systems. Methods for assessing function of these systems are presented. Riviere, Graduate Staff

VMS 563 Systemic Pharmacology and Toxicology Laboratory. *Preqs.: VMS 560, VMS 562 and grad. standing. 1(0-4) F. Alt. yrs.* A series of laboratory exercises are given which are designed to complement the lecture course in Introductory Pharmacology (VMS 560) and Systemic Pharmacology and Toxicology (VMS 562). Bentley, Riviere, Graduate Staff

VMS 590 Special Topics in Veterinary Medical Sciences. *Preq.: Sr. or grad. standing. 1-3 F,S,Sum.* A course designed to present new or special subject matter within the scope of pathology, veterinary microbiology, morphology or pharmacology. The studies may include independent investigations, seminars and/or formal lectures. Graduate Staff

FOR GRADUATES ONLY

VMS 630 Cell Structure. *Preqs.: BCH 451 and VMS 530 or VMA 812 and VMA 822 and CI. 3(2-3) F. Alt. yrs.* The internal components and surface morphologies of the major cell types are studied by analyzing and interpreting photographs taken with the transmission and scanning electron microscopes. Structure-function relationships are stressed. (Techniques of electron microscopy are not taught and electron microscopes are not used in this course.) Henrikson

VMS 631 Applied Veterinary Anatomy I. *Preqs.: DVM or equivalent and CI. 4(2-8) F. Alt. yrs.* This course provides the graduate veterinarian with detailed anatomic information relevant to surgical and medical problems in domestic carnivores. It is designed for graduate veterinarians in pursuit of advanced training in the areas of anatomy, physiology, surgery, radiology and pathology. Smallwood

VMS 640 Cellular and Subcellular Pathology. *Preqs.: VMS 630 and CI. 2(2-0) S. Alt. yrs.* Ultrastructural and biochemical changes occurring in cell injury are studied by the evaluation and interpretation of electron and scanning photomicrographs.

Brown, Graduate Staff

VMS 642 Advanced Systemic Histopathology. *Preq.: Grad. students holding DVM or equivalent degree and CI. 2(1-3) S. Alt. yrs.* Histopathologic changes associated with diseases of various organ systems. The pathogenesis and morphologic changes associated with selected diseases are emphasized.

MacLachlan

VMS 650 Bacterial Pathogenic Mechanisms. *Preqs.: MB 501, VMS 552 or VMM 814. 2(2-0) S. Alt. yrs.* Principles of pathogenesis and host-response in bacterial infections of animals are discussed.

Berkhoff, Carter

VMS 651 Veterinary Medical Virology II. *Preq.: VMM 824 or VMS 550 or CI. 3(2-4) F. Alt. yrs.* Principles of animal viral pathogenesis and host-response to viral infection are presented. The biology of selected viral groups including oncogenic viruses and persistent viruses are discussed. Common laboratory techniques used in virology are stressed.

Coggins, Fuller, Simmons

VMS 653 Advanced Topics in Immunology and Biotechnology. *Preqs.: VMS 553, MB 551 or CI. 1(1-0) F,S,Sum.* A study of selected topics of current interest in immunology/biotechnology. A new topic will be selected each semester to keep the advanced graduate students up to date on the most recent developments in these fields.

DeBuyscher

VMS 654 Epidemiology of Infectious Diseases of International Importance. *Preq.: VMS 554 or CI. 3(2-4) F. Alt. yrs.* Infectious diseases and epidemiological principles are discussed. Selected enteric, zoonotic, nosocomial diseases of worldwide importance are stressed. Population dynamic techniques related to host-vector-agent are considered.

Corbett

VMS 660 Advanced Pharmacology. *Preqs.: VMS 560 or equivalent and CI. 2(2-0) S. Alt. yrs.* An in-depth study of current topics in pharmacology. Subjects include but are not limited to: the actions of drugs on ion permeability, prostaglandins, receptors, pharmacologically active peptides, toxicity of heavy metals and anti-fertility drugs.

Graduate Staff

VMS 661 Pharmacokinetics. *Preqs.: VMS 560 or equivalent, working knowledge of calculus and CI. 3(3-0) F. Alt. yrs.* A course on mathematical models to describe the disposition of drugs and toxic chemicals in the animal body. Areas covered include classic compartmental and nonlinear models as well as physiological approaches. The application of these techniques to toxicologic studies is discussed.

Bai

VMS 690A Special Topics in Veterinary Microbiology. *Preq.: Grad. standing. 1-3 F,S.* Specific topics of study are assigned in various laboratories involved in veterinary microbiology investigation. Students conduct in-depth studies of assigned problem areas.

Graduate Staff

VMS 690B Special Topics in Pathology. *Preqs.: Those holding DVM degree and CI. 1-4 F,S,Sum.* Students perform necropsies, microscopically evaluate tissue changes and prepare written reports of findings. Students conduct in-depth studies of each assigned case.

Brown, Graduate Pathology Staff

VMS 690C Special Topics in Laboratory Pharmacology. *Preqs.: Grad. standing and CI. 1-3 F,S,Sum.* The course involves practical participation in the normal research activities of different laboratories working in pharmacological research. Students pursue a semi-independent project.

Graduate Staff

VMS 694A Seminar in Necropsy Pathology. *Preqs.: Those holding the DVM or equivalent degree and CI. 1(1-0) F,S,Sum.* Description and interpretation of gross changes in tissues from diseased domestic animals. Students attend daily (M-F) 15 to 30 minute review of necropsy lesions presented by a member of the graduate staff.

Brown, Graduate Pathology Staff

VMS 694B Seminar in Surgical Pathology. *Preqs.: Those holding the DVM or equivalent degree and CI. 1(1-0) F,S,Sum.* Description and interpretation of microscopic changes in tissues from diseased domestic and laboratory animals. Students attend and participate in a one-hour weekly seminar where microscopic lesions are described, interpreted and discussed.

Brown, Graduate Pathology Staff

VMS 695A Seminar in Veterinary Microbiology. *Preq.: Grad. standing. 1(1-0) F,S.* Presentation of ongoing research and current topics in microbiology.

Graduate Staff

VMS 696A Seminar in Pharmacology. *Preqs.: Grad. standing and CI. 1(1-0) S.* Presentations and discussions of pharmacological topics of current interest and importance are made.

Graduate Staff in Pharmacology

VMS 699 Research in Veterinary Medical Sciences. *Preq.: Grad. standing. 1-3 F,S,Sum.* Original research in connection with thesis or dissertation problems in veterinary medical sciences.

Graduate Staff

WATER RESOURCES

(An interdepartmental, intercampus graduate program)

WATER RESOURCES COMMITTEE—RALEIGH CAMPUS

Dr. E. H. Wiser (Biological and Agricultural Engineering), *Chairman*

Dr. B. A. Cigler (Political Science and Public Administration), Dr. J. W. Gilliam (Soil Science), Dr. J. D. Gregory (Forestry), Dr. M. T. Huish (Zoology), Dr. V. A. Jones (Food Science), Dr. D. B. Marsland (Chemical Engineering), Dr. H. H. Neunzig (Entomology), Dr. R. B. Palmquist (Economics and Business), Dr. E. D. Seneca (Botany), Dr. T. J. Sheets (Pesticide Residue Research Laboratory), Dr. W. S. Galler (Civil Engineering), Dr. C. W. Welby (Marine, Earth and Atmospheric Sciences), Prof. R. R. Wilkinson (Landscape Architecture)

Water resources management is a major issue throughout the country and national policy supports strong water resources programs at all levels of government. These are multidisciplinary and require understanding of the complex effects of conservation and development. They require well-trained specialists in engineering and the physical, biological and social sciences who also possess a sound grasp of overall objectives and a full appreciation of the respective roles of the participating disciplines.

Water resources is generally considered to be an area of specialization and not a discipline. Graduate education provides an opportunity for broad exposure to water-related subjects along with intensive study in the major disciplines. Students are encouraged to reach beyond their own departments for courses to extend

their range of understanding and to participate in water resources courses and seminars designed to develop interdisciplinary communication and a basis for future working relationships.

A large number of courses related to water resources conservation, development and management are currently offered on the North Carolina State University and University of North Carolina at Chapel Hill campuses. In order to capitalize on the combined educational resources of both campuses and to offer them in an organized way to graduate students seeking interdisciplinary education in this field, an intercampus graduate minor in water resources was established.

The program offers a strong graduate minor in water resources, with the major in any of the basic disciplines contributing to water resources planning, conservation, development and management. The graduate courses currently offered on both campuses have been separated into the following general areas: water law and institutions, planning of water resources and related systems, municipal and industrial water management, agricultural and forest water management, aquatic biology and ecology, hydrology and hydrogeology.

Graduate students majoring in any discipline closely allied with one of the designated water resource areas will be qualified for admission to the program. They will be expected to select their water resources minor courses from one or more areas outside their major. The cohesive elements in the graduate program will be two interdisciplinary core courses including a water resources seminar and a course in water resources planning or water resources economics.

The minimal course requirements for a graduate minor in water resources are: *Master's Degree*—The two core courses in water resources plus two courses in water resource areas outside the major discipline approved by the student's advisory committee; *Ph.D. Degree*—The two core courses in water resources plus five other courses in water resource areas outside the major discipline approved by the student's advisory committee. The complete listing of courses available under this program follows.

WATER RESOURCES CORE COURSES

<i>*Campus</i>	<i>Course</i>	<i>Title</i>
R	CE 591 or	Civil Engineering Seminar. (Water Resources Seminar)
CH	ENVR 183	Special Topics in Water Resources.
R	EB 515 or	Environmental and Resource Policy.
CH	PLAN 234 (ENVR 284)	Water Resources Planning and Policy Analyses.

LAW AND INSTITUTIONS OF WATER RESOURCES

R	PA 508	Urban Politics.
R	PA 511	Public Administration.
R	PA 516	Public Policy Analysis.
R	PA 520	Environmental Policy.
R	PA 613	Government and Planning.
CH	ENVR 283 (PLAN 233)**	Natural Resource Law and Policy.
CH	PLAN 230	Planning Law.
CH	POLI 209	Planning and Government.

CH	POLI 213	Public Administration and Policy Making.
CH	POLI 214	Budgeting and Financial Management.
CH	POLI 238	Intergovernmental Relations.
PLANNING OF WATER RESOURCES AND RELATED SYSTEMS		
R	CE 575**	Civil Engineering Systems.
R	CE 671	Advanced Water Management Systems.
R	EB 401	Economic Analysis for Nonmajors.
R	EB 435	Urban Economics.
R	EB 436	Environmental Economics.
R	EB 490	Senior Seminar in Economics.
R	FOR (UNI) 584	The Practice of Environmental Impact Assessment.
CH	ENVR 217**	Systems Analysis in Environmental Planning.
CH	ENVR 278	Development of a Water Project.
CH	PLAN 219	Environmental Systems Analysis.
CH	PLAN 232 (ENVR 282)**	Public Investment Theory and Techniques.
MUNICIPAL AND INDUSTRIAL WATER MANAGEMENT		
R	BAE (CE) 578	Agricultural Waste Management.
R	CE 484	Water Resources Engineering II.
R	CE 486	Sanitary Engineering Measurements of Water Quality.
R	CE (BAE, MB) 570	Sanitary Microbiology.
R	CE 571	Theory of Water and Waste Treatment.
R	CE 572	Design of Water and Wastewater Facilities.
R	CE 573	Unit Operations and Processes in Waste Treatment.
R	CE 672	Advanced Water and Waste Treatment: Principles and Design.
R	CE 673	Industrial Water Supply and Waste Disposal.
R	CE 674	Stream Sanitation.
R	FS 690	Seminar in Food Science.
R	WPS 525	Pollution Abatement in Forest Products Industries.
CH	ENVR 122	Water Chemistry.
CH	ENVR 134**	Environmental Microbiology.
CH	ENVR 171**	Water Quality Evaluation and Control.
CH	ENVR 174	Water and Waste Treatment Processes.
CH	ENVR 176	Hydraulics and Hydrology.
CH	ENVR 223	Trace Elements in the Environment.
CH	ENVR 271	Engineering Models for Aquatic Systems.
CH	ENVR 272**	Design of Water Systems.
CH	ENVR 273	Water and Wastewater Treatment Plant Design.
CH	ENVR 276	Industrial Water Quality Management.
AGRICULTURAL AND FOREST WATER MANAGEMENT		
R	BAE (SSC) 321***	Water Management.
R	BAE 471	Soil and Water Engineering.
R	FOR 303	Silvics and Forest Ecology.
R	FOR 401	Forest Hydrology and Watershed Management

R	FOR 472	Renewable Resource Policy and Management
R	SSC 461	Soil Physical Properties and Plant Growth.
R	SSC 511	Soil Physics.
AQUATIC BIOLOGY AND ECOLOGY		
R	BO (ZO) 560**	Principles of Ecology.
R	BO (MB) 574	Phycology.
R	BO 662	Applied Coastal Ecology.
R	MEA (ZO) 520	Principles of Biological Oceanography.
R	MEA 693	Advanced Special Topics. (Estuarine Ecology)
R	ZO (FW) 420	Fishery Science.
R	ZO (ENT) 509	Ecology of Stream Invertebrates.
R	ZO (FW) 515	Growth and Reproduction of Fishes.
R	ZO (FW) 586	Aquaculture I.
R	ZO 619	Advanced Limnology.
R	ZO 621	Fishery Science.
R	ZO (MEA) 624	Ecology of Fishes.
CH	BIOL 109**	Introduction to Hydrobiology.
CH	BIOL 126 (MSCS 101)**	Oceanography.
CH	BIOL 140 (MSCS 140)**	Biological Oceanography.
CH	BIOL 141S	Special Problems in Marine Biology.
CH	BIOL 146	Marine Ecology.
CH	BIOL 186	Systems Ecology.
CH	BIOL 213	Advanced Marine Ecology.
CH	ENVR 123	Organic Materials in Natural Waters.
CH	ENVR 128 (MSCS 105)	Chemical Oceanography.
CH	ENVR 132**	Limnology and Water Pollution.
CH	ENVR 137	Ecology of Wetlands.
CH	ENVR 231	Limnological Methods.
CH	ENVR 233	Microbial Ecology.
CH	ENVR 235	Ecology of Phytoplankton.
HYDROLOGY AND HYDROGEOLOGY		
R	BAE (SSC) 671	Theory of Drainage—Saturated Flow.
R	BAE (SSC) 674	Theory of Drainage—Unsaturated Flow.
R	CE 383**/**	Water Resources Engineering I.
R	CE 580	Flow in Open Channels.
R	CE 585	Urban Stormwater Management.
R	CE 644	Ground Water Engineering.
R	MEA 300***	Environmental Geology.
R	MEA 311***	Physical Climatology.
R	MEA 481	Principles of Geomorphology.
R	MEA 555	Meteorology of the Biosphere.
R	MEA 562	Applied Sedimentary Analysis.
R	MEA 565**	Hydrogeology.
R	MEA 566**	Hydrogeology of Groundwater Pollution and Protection.
R	MEA 567**	Geochemistry.
R	MEA 580	Remote Sensing.
R	SSC 511	Soil Physics.
CH	ENVR 281	Topics in Advanced Hydrology.
CH	GEOG 110	Meteorology.
CH	GEOG 112	Micrometeorology.

CH	GEOG 115	Climatology.
CH	GEOG 117	Soils.
CH	GEOG 156	Natural Resources.
CH	GEOL 138	Geomorphology.
CH	GEOL 145	Principles of Geochemistry.
CH	GEOL 188 (MSCS 103)	Geological Oceanography.
CH	MSCS 122	Physical Oceanography.
CH	MSCS 206	Seminar on Oceanography.

Requests for information regarding the water resources graduate programs should be directed to the Chairman of the Water Resources Committee, the departments represented on the Water Resources Committee or the Water Resources Research Institute, 225 Page Hall, North Carolina State University, Raleigh, N. C. 27695-7912.

* Courses bearing the prefix "R" are taught at Raleigh and those bearing "CH" at Chapel Hill. Unlisted courses can be substituted for listed courses with the approval of the student's advisory committee.

**Courses from which requirements for master's degree minor will normally be met. Substitutions can be made with approval of the student's advisory committee.

***Not graduate level courses.

Wood and Paper Science

GRADUATE FACULTY

Professor R. J. Thomas, Head

Professor R. G. Pearson, Graduate Administrator

Professors: A. C. Barefoot Jr., H.-m. Chang, E. B. Cowling, E. L. Ellwood, I. S. Goldstein, J. S. Gratzl, C. A. Hart, R. G. Hitchings, M. W. Kelly, M. P. Levi, H. G. Olf; Adjunct Professors: L. L. Edwards, W. T. McKean Jr., R. P. Singh; Professor Emeritus: A. J. Stamm; Associate Professors: R. H. Cornell, T. W. Joyce, D. H. J. Steensen, E. A. Wheeler; Adjunct Associate Professors: T. K. Kirk, R. B. Phillips; Associate Professor Emeritus: C. G. Landes; Assistant Professor: J. Denig; Research Associate: C. L. Chen

Graduate study programs leading to the Master of Science and the Doctor of Philosophy degrees are offered for students in a wide variety of areas in the field of wood and paper science. The Master of Wood and Paper Science is available for students who do not wish to emphasize research in their graduate study programs.

Because the field of wood and paper science is a derived science, considerable emphasis is placed upon developing a strong minor in the graduate program in any one or more of the supporting disciplines such as organic chemistry, polymer chemistry, chemical engineering, mathematics, statistics, biology, engineering mechanics, mechanical engineering, physics, economics or business administration.

Areas of study and research in pulp and paper science and technology cover wood and fiber chemistry, lignin and carbohydrate chemistry, pulping chemistry, pollution abatement processes, fiber and paper properties and paper coatings and ad-

ditives. In wood science and technology, study and research areas include wood physics (especially wood liquid relations), wood chemistry, wood biology, wood mechanics and engineering, manufacturing processes, wood-based industry economics and marketing.

Modern facilities equipped to conduct education and research in all forms of wood and fiber processing are available. Included are specialized laboratories for the study of wood physics, wood anatomy, wood processing, wood engineering, wood chemistry, pulping, papermaking, paper testing and paper coating. Equipment available includes optical and electron microscopes, a range of spectrometers, gas, liquid and ion chromatographs, ultracentrifuge, membrane osmometers, electron spin resonance, nuclear magnetic resonance apparatus weatherometer, a range of lumber and paper testing machines, molecular filtration equipment and excellent computer and computer graphics facilities.

The prerequisite for graduate study in the department is an undergraduate degree in wood science, pulp and paper science or in related disciplines such as any of a number of branches of science or engineering.

SELECTED ADVANCED UNDERGRADUATE COURSES

WPS 403 Paper Process Analysis. *Preqs.: WPS 321, 322. 3(1-6) S.*

WPS 410 Pulp and Paper Systems Analysis and Control. *Preq.: WPS 322 or WPS 360. 3(3-0) F.*

WPS 413 Paper Properties and Additives. *Preq.: Sr. standing. 3(1-6) F.*

WPS 415 Project Management and Analysis I. *Preq.: Sr. standing in pulp and paper science and technology. 2(2-0) F.*

WPS 416 Project Management and Analysis II. *Preq.: WPS 415. 2(2-0) S.*

WPS (FOR) 434 Quantitative Methods of Decision Making for Forest Products. *Preqs.: MA 113 and 114 and WPS (FOR) 273. 3(3-0) S.*

WPS 441 Introduction to Wood Mechanics. *Preqs.: MA 212, PY 221 or 211. 3(3-0) F.*

WPS 442 Wood Mechanics and Structural Design. *Preq.: CE 211 or WPS 441. 3(2-3) S.*

WPS 471 Pulping Process Analysis. *Preqs.: WPS 321, WPS 322. 3(1-6) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

WPS 513 Tropical Woods. *Preq.: WPS 202. 2(1-3) F. Alt. yrs.* Structure, identification, properties, characteristics and use of tropical woods, especially those used in plywood and furniture.
Wheeler

WPS 515 Surface and Colloid Chemistry of Papermaking. *Preq.: CH 331 or CH 431. 3(3-0) S.* The fundamental principles of surface and colloid chemistry important in papermaking and their application to optimizing wet-end processes. The electrokinetic basis of flocculation, retention and other wet-end phenomena and the science of wet-end additives.

Olf

WPS 521 Chemistry of Wood Polysaccharides. *Preqs.: CH 223 and WPS 332 or BCH 451. 3(3-0) F. Alt. yrs.* Fundamental chemistry and physical chemistry of monosaccharides and polysaccharides with emphasis on hemicellulose and cellulose. Topics include construction and configuration, stereochemistry, solution properties, molecular weight determination and reactivity.
Chang, Gratzl

WPS 522 Chemistry of Lignin and Extractives. *Preqs.: CH 223 and WPS 332 or BCH 451. 3(3-0) S. Alt. yrs.* A study of the biosynthetic pathways, structure and reactivity of lignin and wood extractives with emphasis on topics important to pulping and conversion to useful by-products.
Chang, Gratzl

WPS 525 Pollution Abatement in Forest Products Industries. *Preq.: Grad. or advanced undergrad. standing in science or engineering curricula. 3(3-0) S.* Pollution sources, inplant control and treatment of water and air pollution in forest products with concentration on the pulp and paper industry.
Joyce

WPS 533 Advanced Wood Anatomy. *Preq.: WPS 202 or CI. 3(1-6) S. Alt. yrs.* Fundamental wood anatomy and cell wall ultrastructure. Laboratory techniques for light and electron microscopic studies of wood.
Wheeler

WPS 540 Wood Composites. *Preqs.: WPS 441; grad. or advanced undergrad. standing. 3(3-0) S. Alt. yrs.* This course is designed to acquaint advanced undergraduate and graduate students with the rapidly expanding field of wood composites. Production processes for particleboard, plywood, hardboard, fiberboard, and other wood composites are presented. Elastic theory for the stiffness, strength, and buckling resistance of composites will be developed. Test procedures for determining mechanical properties and design procedures for glued laminated members, panel products, and built-up members, including I- and box-beams, stressed-skin panels and sandwich panels, will be outlined.
Kelly, Pearson

WPS 560 Advanced Pulp and Paper Process Analysis. *Preqs.: WPS 321 and 322. 3(3-0) S.* Design and analysis of pulp and paper mill processes; process control applications in pulping, chemical recovery, bleaching and papermaking; principles of pulp mill chemical and energy recovery; and new alkaline pulping recovery technology.
Kirkman

WPS 591 Wood and Paper Science Problems. *Preq.: Sr. or grad. standing. Credits Arranged.* Assigned or selected problems in the field of silviculture, logging, lumber manufacturing, pulp technology or forest management.
Graduate Staff

WPS 599 Methods of Research in Wood and Paper Science. *Preq.: Advanced undergrad. or grad. standing. Credits Arranged.* Research procedures, problem outlines, presentation of results; consideration of selected studies by forest research organizations; sample plot techniques.
Graduate Staff

FOR GRADUATES ONLY

WPS 604 Timber Physics. *Preqs.: MA 212, PY 221, WPS 202. 3(3-0) F. Alt. yrs.* Density, specific gravity and moisture content variation affecting physical properties; physics of drying at high and low temperatures; thermal, sound, light and electrical properties of wood.
Hart

WPS 606 Wood Process Analysis. *Preq.: WPS 604. 3(3-0) F.* Analysis of wood processes through the solution of comprehensive problems involving the physics of temperature and moisture relations.
Graduate Staff

WPS 691 Graduate Seminar. *Preq.: Grad. standing. 1(1-0) F,S.* Presentation and discussion of progress reports on research, special problems and outstanding publications.
Graduate Staff

WPS 693 Advanced Wood and Paper Science Problems. *Preq.: Grad. standing. Credits Arranged. F,S.* Selected problems in the field of wood and paper science. Graduate Staff

WPS 699 Problems and Research. *Preq.: Grad. standing. Credits Arranged.* Specific problems that will furnish material for a thesis. Graduate Staff

Zoology

GRADUATE FACULTY

Professor J. G. Vandenberg, Head

Professor G. C. Miller, Graduate Administrator

Professors: G. T. Barthalmus, P. C. Bradbury, B. J. Copeland, P. D. Doerr, W. C. Grant, C. F. Lytle, J. M. Miller, R. L. Noble, J. F. Roberts, D. E. Smith, H. A. Underwood Jr., T. G. Wolcott; *Professor (USDI):* M. T. Huish; *Adjunct Professors:* F. A. Cross, J. B. Funderburg, J. D. Hair, G. R. Huntsman; *Professors Emeriti:* D. E. Davis, W. W. Hassler, L. E. Mettler, T. L. Quay; *Associate Professors:* B. L. Black, R. M. Grossfeld, R. A. Lancia, S. C. Mozley, K. H. Pollock, R. A. Powell, L. A. Real; *Associate Professor (USDI):* J. H. Kerby; *Adjunct Associate Professors:* R. L. Ferguson, D. E. Hoss, C. S. Manooch III, D. S. Peters, L. W. Reiter, R. McL. Shelley, G. W. Thayer; *Assistant Professors:* M. N. Feaver, R. G. Hodson, G. J. San Julian, J. R. Walters; *Adjunct Assistant Professor:* D. R. Colby

The Department of Zoology offers the Master of Life Science, Master of Science and Doctor of Philosophy degrees. Areas of concentration in the department include: cellular biology and physiology, ecology and behavior, and fisheries and wildlife biology. Within these areas students can specialize in such topics as: developmental biology at the cellular or gene level, cell membrane transport systems, protozoology, parasitology, reproductive physiology, biorhythms, theoretical or applied studies in ecology, wildlife management, aquaculture, and many others.

Excellent research facilities for cellular and organismic work are available in Gardner Hall. Field work can be conducted at near-by research stations and at various state and federal laboratories associated with the department.

Applicants should have a strong background in the biological sciences. Stipends are available for qualified individuals. Application at least six months before the anticipated enrollment date is encouraged.

SELECTED ADVANCED UNDERGRADUATE COURSES

ZO 410 Introduction to Animal Behavior. *Preqs.: BS 100 and either ZO 201 or ZO 303. 3(3-0) F.*

ZO (BO) 414 Cell Biology. *Preqs.: CH 223, PY 212, ZO 201 or ZO 303. 3(3-0) S.*

ZO 415 Cellular and Animal Physiology Laboratory. *Coreq.: ZO 414 or ZO 421. 2(0-5) F,S.*

ZO (FW) 420 Fishery Science. *Preqs.: ZO 201 or ZO 303; ZO (BO) 360. 3(2-2) F.*

ZO 421 Vertebrate Physiology. *Preqs.: CH 223, PY 212, ZO 201 or ZO 303. 3(3-0) F,S,Sum.*

ZO (ENT) 425 General Entomology. *Preq.: ZO 201 or equivalent. 3(2-3) F,Sum.*

ZO 441 Ichthyology. *Preqs.: ZO 201 or ZO 303, jr. standing. 3(3-0) S.*

ZO 442 Ichthyology Laboratory. *Preq.: ZO 201 or 203; Coreqs.: ZO 441, jr. standing. 1(0-3) S.*

ZO 490 Special Topics in Zoology. *1-3.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ZO 501 Ornithology. *Preqs.: ZO 323 or 303, ZO 421. 3(2-3) S.* The biology of birds: systematics, physiology, life histories, ecology and behavior. Walters

ZO (PHY) 503 General Physiology I. *3(3-0) F.* (See physiology.)

ZO (PHY) 504 General Physiology II. *3(3-0) S.* (See physiology.)

ZO (ST) 506 Sampling Animal Populations. *3(3-0) F. Alt. yrs.* (See statistics.)

ZO (ENT) 509 Ecology of Stream Invertebrates. *Preqs.: ZO 201 or 302, BO (ZO) 360 or equivalent. 4(2-6) S. Alt. yrs.* Introduction to stream ecology and analysis of animal communities. Lectures cover community structure and function, life histories of dominant animals, sampling design and techniques and responses to pollution. Laboratory exercises include field collections, identification of animals and quantitative research techniques. A personal collection of animals and a weekend field trip to mountain streams are required. Mozley

ZO 510 Animal Behavior Research Techniques. *Preqs.: ZO 410 or grad. standing in ZO, ST 311 or equivalent. 3(1-5) S.* Introduction to laboratory and field techniques used in animal behavior research. Course emphasizes modern methods of recording and analyzing behavioral data but also covers experimental manipulation of behavior by external stimuli and physiological alterations. Graduate Staff

ZO 512 Animal Symbiosis. *Preq.: 12 hrs. of biology and zoology. 3(3-0) S. Alt. yrs.* Symbiotic associations of animals including mutualism, commensalism and parasitism. The morphological, physiological, behavioral and ecological adaptations of symbionts and the complex interactions between partner species. Lytle, G. Miller

ZO (PHY) 513 Comparative Physiology. *Preq.: ZO 421 or CI. 4(3-3) S.* A comparative study of the organ systems of vertebrates and the physiological processes involved in maintaining the homeostatic state. The various compensatory mechanisms employed during environmental stress are included. Graduate Staff

ZO (FW) 515 Growth and Reproduction of Fishes. *Preqs. or coreqs.: GN 411, ZO 420, 421, 441. 3(2-3) S. Alt. yrs.* The biology of fishes: physiology, anatomy, pathology, behavior and genetics. This course is designed especially for graduate students in fisheries. Several trips to research laboratories are taken. Kerby

ZO 517 Population Ecology. *Preqs.: ZO (BO) 360 and ST 511 or equivalent. 3(3-0) S.* The dynamics of natural populations. Current work, theories and problems dealing with population growth, fluctuation, limitation and patterns of dispersion, species interactions, community structure and ecological genetics. Real

ZO 519 Limnology. *Preqs.: Grad. standing and CI. Credit in both ZO 419 and ZO 519 is not allowed. 4(3-3) F.* Structure and function of lakes and ponds, including physical, chemical and biological controls of productivity and species composition of aquatic plants and animals and effects of pollution on water quality. One local weekend field trip is required.

Mozley

ZO (MEA) 520 Principles of Biological Oceanography. *3(3-0) S.* (See marine, earth and atmospheric sciences.)

ZO (PO) 524 Comparative Endocrinology. *4(3-3) S.* (See poultry science.)

ZO (GN) 532 Biological Effects of Radiations. *3(3-0) S.* (See genetics.)

ZO (MEA) 534 Marine Benthic Ecology. *3(3-0) S. Alt. yrs.* (See marine, earth and atmospheric sciences.)

ZO (GN) 540 Evolution. *3(3-0) F.* (See genetics.)

ZO 542 Herpetology. *Preqs.: ZO 323 or 303, ZO 421. 3(2-3) S. Alt. even.* The biology of the amphibians and reptiles: systematics, life history, anatomy, behavior, physiology and ecology.

Graduate Staff

ZO 544 Mammalogy. *Preq.: ZO 323 or ZO 303. 4(3-3) F.* The biology of mammals: evolution, functional morphology, reproduction, behavior, ecology, population biology, classification and identification. One weekend field trip is planned.

Powell

ZO (FW) 553 Principles of Wildlife Science. *Preq.: ZO (BO) 360. 3(2-3) F.* The principles of wildlife management and their application are studied in the laboratory and in the field.

Doerr

ZO (FW) 554 Wildlife Field Studies. *Preqs.: ZO 553, ST 311; CI. 3(2-3) S. of odd yrs.* Field application of methods for studying vertebrate wildlife populations; sampling methods, data gathering, analysis and interpretation of results are practiced. Participation in field laboratories and one or two weekend field trips is required.

Doerr

ZO (MB) 555 Protozoology. *Preq.: CI. 4(2-6) S. Alt. odd.* The biology of the Protozoa: lectures include morphology, physiology, ecology, genetics, reproduction, evolution, systematics and life-cycles of both free-living and parasitic taxa; laboratory will stress recognition of selected forms and demonstrate techniques used to prepare specimens for microscopic examination.

Bradbury

ZO (BO) 560 Principles of Ecology. *Preq.: Three semesters of college-level biology courses. 4(3-3) F.* A consideration of the principles of ecology at the graduate level. Each of the major subject areas of ecology is developed in sufficient depth to provide a factual and philosophical framework for the understanding of ecology.

Graduate Staff

ZO 581 Helminthology. *Preqs.: ZO 323 or 303, ZO 315 or equivalent. 4(2-4) F. Alt. odd.* The study of the morphology, biology and control of parasitic helminths.

G. Miller

ZO (ENT) 582 Medical and Veterinary Entomology. *3(2-3) S.* (See entomology.)

ZO (FW) 586 Aquaculture I. *Preqs.: ZO (BO) 360, sr. or grad. standing. 3(3-0) F.* The biological and general principles of aquaculture. Lectures emphasize the present status of aquaculture, species involved, techniques employed, and problems encountered. Recent ad-

vances in research and development are discussed and areas of future research and development are identified. Graduate Staff

ZO (FW) 587 Aquaculture I Laboratory. *Preqs.: ZO (BO) 360, sr. or grad. standing; Coreq.: ZO 586. 1(0-3) F.* Methods and techniques of cultivating aquatic organisms. Field trips and reports on local hatcheries and facilities are required. (Three to four overnight field trips will be taken on week days to coastal areas, state hatcheries, and private hatcheries; students are responsible for shared room costs and their meals. Four field trips will also be taken on laboratory day within driving range of Raleigh.) Graduate Staff

ZO 590 Special Studies. *Preqs.: Twelve hours ZO, CI. Credits Arranged. F,S.* A directed individual investigation of a particular problem in zoology, accompanied by a review of the pertinent literature. A maximum of three hours is allowed toward the master's degree. Graduate Staff

ZO 592 Topical Problems. *Preq.: CI. 1-3 F,S.* Organized, formal lectures and discussion of a special topic. Graduate Staff

ZO 593 Aquatic Ecology Seminar. *Preqs.: Grad., PBS or sr. standing; one course in aquatic, marine or fisheries areas. 1-3 F,S.* Presentations and discussions of recent research and topical issues in aquatic and marine sciences. Each student enrolled for credit must make at least one presentation. Mozley

FOR GRADUATES ONLY

ZO 603 Advanced Parasitology. *Preq.: ZO 581. 3(2-3) S. Alt. even.* The study of the theoretical and practical aspects of parasitism; taxonomy, physiology and immunology of animal parasites. G. Miller

ZO 614 Advanced Cell Biology. *Preq.: ZO (BO) 414 or equivalent. 3(3-0) S. Alt. yrs.* A study of the current problems of cell biology including the problems of the molecular organization and functions of membrane systems, subcellular organelles and specialized cells. Roberts, Smith

ZO 619 Advanced Limnology. *Preq.: ZO 419. 3(3-0) Alt. yrs.* Recent topics in limnological research. Lectures and discussion will draw from journal articles on physical, chemical and biological aspects, including nutrient control of productivity, predator control of community structure and determinants of water quality. A research paper or project is required. Mozley

ZO 621 Fishery Science. *Preqs.: ST 511, ZO 420, a course in calculus. 3(2-3) F. Alt. yrs.* An analysis of fishery research methods. Population enumeration and dynamics. The relationship between fluctuations in natural populations and environment factors. Graduate Staff

ZO (MEA) 623 Advanced in Marine Community Ecology. *3(3-0) S. Alt. yrs.* (See marine, earth and atmospheric sciences.)

ZO (MEA) 624 Ecology of Fishes. *3(3-0) F.* (See marine, earth and atmospheric sciences.)

ZO 644 Advanced Topics in the Study of Mammals. *Preq.: ZO 544. 3(2-3) S.* Current topics in the study of mammals with concentration each year on a different topic, such as community ecology, population biology, evolution or functional morphology. Student research projects required. Powell

ZO (BO) 660 Advanced Topics in Ecology I. *4(3-3) S.* (See botany.)

ZO (BO) 661 Advanced Topics in Ecology II. *Preq.: ZO (BO) 560 or equivalent. 4(3-3) S. Alt. yrs.* Reports and seminar discussions of five major topics, such as secondary productivity, competitive exclusion, predator-prey and other interspecies relationships, regulation of populations, physiological ecology and management of resources. Some field trips. Laboratory provides experience in analysis of ecological systems, modeling and computer simulation. Graduate Staff

ZO 690 Seminar. *1(1-0) F,S.* The presentation and defense of original research and current literature. Graduate Staff

ZO 691 Topics in Animal Behavior. *Preq.: ZO 510. 3(3-0) S.* Intensive examination of selected aspects of animal behavior and their relationship to physiology, ecology and other biological fields. May be repeated for credit when topic changes. Walters

ZO 699 Research in Zoology. *Preqs.: Twelve semester credits in ZO and CI. Credits Arranged. F,S.* Graduate Staff

GRADUATE FACULTY*

NORTH CAROLINA STATE UNIVERSITY

- Abbate, Angelo Rudy*, Associate Professor of Design. M.L.A., University of Pennsylvania.
- Abrams, Charlie Frank, Jr.*, Professor of Biological and Agricultural Engineering. Ph.D., North Carolina State University.
- Adams, David Arthur*, Visiting Associate Professor of Forestry and University Studies. Ph.D., North Carolina State University.
- Adams, William M.*, Professor of Food Animal and Equine Surgery; Associate Dean of Veterinary Medicine and Director of Veterinary Medical Services. V.M.D., University of Pennsylvania.
- Afify, Elsayed M.*, Professor of Mechanical and Aerospace Engineering. Ph.D., University of Michigan.
- Agrawal, Dharmu Prakash*, Professor of Electrical and Computer Engineering. Ph.D., Federal Institute of Technology, Lausanne, Switzerland.
- Ahmad, Shuaib Haroon*, Assistant Professor of Civil Engineering. Ph.D., University of Illinois.
- Alexander, Samuel Thomas*, Assistant Professor of Electrical and Computer Engineering. Ph.D., North Carolina State University.
- Alexander, Winser E.*, Professor of Electrical and Computer Engineering. Ph.D., University of New Mexico.
- Allen, Howard Lee, Jr.*, Assistant Professor of Forestry and Soil Science; Director of the Forest Fertilization Cooperative. Ph.D., North Carolina State University.
- Allen, Steven G.*, Associate Professor of Economics and Business. Ph.D., Harvard University.
- Altman, Richard S.*, Visiting Lecturer (part-time) in Design. M. Arch., Washington University.
- Alvarez, Raul Eduardo*, Professor of Industrial Engineering. M.S., North Carolina State University.
- Ambrose, John Thomas*, Associate Professor of Entomology. Ph.D., Cornell University.
- Amein, Michael*, Professor of Civil Engineering and Marine, Earth and Atmospheric Sciences. Ph.D., Cornell University.
- Amerson, Henry Van*, Associate Professor of Botany and Forestry. Ph.D., North Carolina State University.
- Amoozegar-Fard, Aziz*, Assistant Professor of Soil Science. Ph.D., University of Arizona.
- Anderson, Charles Eugene*, Professor of Botany. Ph.D., Purdue University.
- Anderson, Clifton A.*, Professor Emeritus of Industrial Engineering. Ph.D., Ohio State University.
- Anderson, Donald Benton*, Professor Emeritus of Botany. Ph.D., Ohio State University.
- Anderson, James Michael*, Assistant Professor (USDA) of Botany and Crop Science. Ph.D., Purdue University.
- Anderson, John R., Jr.*, Associate Professor of Crop Science. Ph.D., University of Illinois.
- Anderson, Kevin Lindsay*, Assistant Professor of Food Animal and Equine Medicine. Ph.D., University of Illinois.
- Anderson, Marshall W.*, Adjunct Professor of Biomathematics. Ph.D., University of Tennessee.
- Anderson, Norman Dean*, Professor of Mathematics and Science Education. Ph.D., Ohio State University.

* Membership in the graduate faculty may be in either of two categories: (1) full status or (2) associate status. Full status permits a faculty member to engage in any and all phases of the graduate programs of the University. Associate members may teach courses at the graduate level and serve as chairmen of master's advisory committees.

- Anderson, Ronald F.*, Adjunct Associate Professor of Counselor Education. Ph.D., University of Florida.
- Anderson, Ruth D.*, Assistant Professor of Speech-Communications. Ph.D., University of Oregon.
- Andrews, Grover J.*, Visiting Associate Professor of Adult and Community College Education and Associate Vice Chancellor for University Extension and Public Service. Ed.D., North Carolina State University.
- Antonelli, Douglas Charles*, Adjunct Associate Professor of Industrial Engineering. Ph.D., North Carolina State University.
- Apperson, Charles Smith*, Associate Professor of Entomology. Ph.D., University of California at Riverside.
- Apple, Jay Lawrence*, Professor of Genetics and Plant Pathology; Coordinator of International Programs. Ph.D., North Carolina State University.
- Arends, James Jay*, Assistant Professor of Entomology. Ph.D., Oklahoma State University.
- Argenzio, Robert Alen*, Professor of Anatomy, Physiological Sciences and Radiology. Ph.D., Cornell University.
- Armstrong, Frank Bradley*, University Professor of Biochemistry, Genetics and Microbiology. Ph.D., University of California at Berkeley.
- Armstrong, Pamela Jane*, Assistant Professor of Companion Animal and Special Species Medicine. D.V.M., Ontario Veterinary College, Guelph, Ontario, Canada.
- Arnold, John F.*, Associate Professor of Curriculum and Instruction. Ph.D., University of Connecticut.
- Aronson, Arthur L.*, Professor of Veterinary Anatomy, Physiological Sciences and Radiology and Head of the Department. Ph.D., University of Minnesota.
- Arya, Satya Pal Singh*, Professor of Marine, Earth and Atmospheric Sciences. Ph.D., Colorado State University.
- Ater, Steven K.*, Assistant Professor of Design. M.F.A., University of Illinois.
- Atkinson, Maxine P.*, Assistant Professor of Sociology and Anthropology. Ph.D., Washington State University.
- Aubrecht, Lyn G.*, Adjunct Assistant Professor of Curriculum and Instruction. Ph.D., Ohio State University.
- Auciello, Orlando Hector*, Visiting Associate Professor of Nuclear Engineering. Ph.D., National University of Cuyo, Bariloche, Argentina.
- Aurand, Leonard William*, Professor of Food Science and Biochemistry. Ph.D., Pennsylvania State University.
- Austin, William Wyatt, Jr.*, Professor Emeritus of Materials Engineering. Ph.D., Vanderbilt University.
- Averre, Charles Wilson, III*, Professor of Plant Pathology. Ph.D., Purdue University.
- Axtell, Richard Charles*, Professor of Entomology. Ph.D., Cornell University.
- Aycock, Robert*, Professor of Plant Pathology and Horticultural Science; Head of the Department of Plant Pathology. Ph.D., North Carolina State University.
- Ayoub, Mahmoud Amin*, Professor of Industrial Engineering. Ph.D., Texas Technological University.
- Babcock, Willard Farrington*, Professor Emeritus of Civil Engineering. S.M., Massachusetts Institute of Technology.
- Bachelor, Jack S.*, Associate Professor of Entomology. Ph.D., University of Florida.
- Bachmann, Klaus Jurgen*, Professor of Chemistry. Ph.D., Freie Universitat, Berlin, West Germany.
- Bai, Stephen A.*, Assistant Professor of Anatomy, Physiological Sciences and Radiology. Ph.D., George Washington University.
- Bailey, Jack Eugene*, Assistant Professor of Plant Pathology. Ph.D., Michigan State University.
- Bailey, John Albert*, Professor of Mechanical and Aerospace Engineering and Head of the Department. Ph.D., University College of Swansea.
- Baines, Barbara Joan*, Professor of English. Ph.D., Ohio University.
- Baird, Jack Vernon*, Extension Professor of Soil Science and Specialist in Charge. Ph.D., Washington State University.

- Baker, James Robert*, Associate Professor of Entomology. Ph.D., University of Kansas.
- Balik, Charles Maurice*, Assistant Professor of Chemical Engineering and Materials Engineering. Ph.D., Case Western Reserve University.
- Ball, David Stafford*, Associate Professor of Economics and Business. Ph.D., University of North Carolina at Chapel Hill.
- Ball, Hershell Ray, Jr.*, Professor of Food Science. Ph.D., University of Missouri.
- Ballas, Lawrence M.*, Assistant Professor of Anatomy, Physiological Sciences and Radiology. Ph.D., Cornell University.
- Ballinger, Walter Elmer*, Professor of Horticultural Science. Ph.D., Michigan State University.
- Ballington, James Ralph*, Associate Professor of Horticultural Science. Ph.D., North Carolina State University.
- Banker, James Roderick*, Associate Professor of History and Graduate Administrator. Ph.D., University of Rochester.
- Bao, Han*, Assistant Professor of Industrial Engineering. Ph.D., University of New South Wales, Sydney, Australia.
- Barclay, William John*, Professor Emeritus of Electrical and Computer Engineering. Ph.D., Stanford University.
- Barefoot, Aldos Cortez, Jr.*, Professor of Wood and Paper Science and University Studies. D.F., Duke University.
- Barker, David Arthur*, Assistant Professor of Marine, Earth and Atmospheric Sciences. Ph.D., University of Wisconsin.
- Barker, James Albert*, Adjunct Assistant Professor of Forestry. Ph.D., North Carolina State University.
- Barker, James Cathey*, Extension Professor of Biological and Agricultural Engineering. Ph.D., University of Tennessee.
- Barker, Kenneth Reece*, Professor of Plant Pathology. Ph.D., University of Wisconsin.
- Barker, Roger Lee*, Associate Professor of Textile Engineering and Science. Ph.D., Clemson University.
- Barkley, Key Lee*, Professor Emeritus of Psychology. Ph.D., University of North Carolina at Chapel Hill.
- Barnes, Donald Warren, Jr.*, Associate Professor Emeritus of Architecture. Ph.D., Texas A&M University.
- Barnes, Harold John*, Professor of Food Animal and Equine Medicine. Ph.D., Ahmadu Bello University, Zaira, Nigeria.
- Barnwell, Richard W.*, Adjunct Associate Professor of Mechanical and Aerospace Engineering. Ph.D., Virginia Polytechnic Institute and State University.
- Barrax, Gerald W.*, Associate Professor of English. M.A., University of North Carolina at Chapel Hill.
- Barrick, Elliott Ray*, Professor Emeritus of Animal Science. Ph.D., Purdue University.
- Barthalmus, George Timothy*, Professor of Zoology. Ph.D., Pennsylvania State University.
- Bartholomew, William Victor*, Professor Emeritus of Soil Science. Ph.D., Iowa State University.
- Barwick, Allen J.*, Adjunct Assistant Professor of Industrial Engineering. Ph.D., North Carolina State University.
- Bassett, John E.*, Professor of English and Head of the Department. Ph.D., University of Rochester.
- Batchelor, Peter*, Professor of Architecture. M.C.P., University of Pennsylvania.
- Bateman, Durward F.*, Professor of Plant Pathology; Associate Dean of the School of Agriculture and Life Sciences and Director of the Agricultural Research Service. Ph.D., Cornell University.
- Batra, Subhash K.*, Professor of Textile Engineering and Science. Ph.D., Rensselaer Polytechnic Institute.
- Batte, Edward Guy*, Professor Emeritus of Veterinary Medicine. D.V.M., Texas A&M University.
- Baughman, Gerald Robert*, Associate Professor of Biological and Agricultural Engineering. Ph.D., Ohio State University.

- Baumer, David L.*, Assistant Professor of Economics and Business. Ph.D., University of Virginia.
- Beatty, Kenneth Orion, Jr.*, Professor Emeritus of Chemical Engineering. Ph.D., University of Michigan.
- Beckmann, Robert Lee, Jr.*, Associate Professor of Botany. Ph.D., Vanderbilt University.
- Bedair, Salah Mohamed*, Professor of Electrical and Computer Engineering. Ph.D., University of California at Berkeley.
- Beeler, Joe Robert, Jr.*, Professor of Materials Engineering. Ph.D., Kansas State University.
- Beers, Burton Floyd*, Professor of History and Head of the Department. Ph.D., Duke University.
- Beezer, Bruce Gerald*, Associate Professor of Educational Leadership and Program Evaluation and Acting Head of the Department. Ed.D., University of Arizona.
- Beezley, William H.*, Professor of History. Ph.D., University of Nebraska.
- Behlow, Robert Frank*, Professor of Animal Science and Food Animal and Equine Medicine. D.V.M., Ohio State University.
- Belcher, Clifton Beryl*, Adjunct Assistant Professor of Occupational Education. Ed.D., North Carolina State University.
- Bell, Norman Robert*, Associate Professor Emeritus of Electrical and Computer Engineering. M.S., Cornell University.
- Bell, Thomas Alexander*, Professor Emeritus of Food Science. M.S., North Carolina State University.
- Bend, John Richard*, Adjunct Professor of Entomology. Ph.D., Sydney University, Australia.
- Bengtson, Neal M.*, Assistant Professor of Computer Science. Ph.D., Purdue University.
- Bennett, Willard Harrison*, Professor Emeritus of Physics. Ph.D., University of Michigan.
- Benson, David Michael*, Associate Professor of Plant Pathology and Graduate Studies Coordinator. Ph.D., Colorado State University.
- Benson, Geoffrey Alan*, Associate Professor of Economics and Business. Ph.D., Pennsylvania State University.
- Benson, Ray Braman, Jr.*, Professor of Materials Engineering. Ph.D., University of California at Berkeley.
- Bent, Henry Albert*, Professor of Chemistry. Ph.D., University of California at Berkeley.
- Bentley, Peter John*, Professor of Anatomy, Physiological Sciences and Radiology. Ph.D., University of Western Australia, Nedlands, Australia.
- Bereman, Robert Deane*, Professor of Chemistry and Associate Dean for Academic Affairs, School of Physical and Mathematical Sciences. Ph.D., Michigan State University.
- Berger, Robert L.*, Associate Professor of Statistics. Ph.D., Purdue University.
- Berkhoff, Herman A.*, Professor of Microbiology, Pathology and Parasitology. Ph.D., Cornell University.
- Berkstresser, Gordon Abbott III*, Associate Professor of Textile Management and Technology and Head of the Department. Ph.D., City University of New York.
- Bernhard, Richard Harold*, Professor of Industrial Engineering. Ph.D., Cornell University.
- Betts, Charles W.*, Professor of Companion Animal and Special Species Medicine. D.V.M., Colorado State University.
- Betts, Leonidas Judd, Jr.*, Associate Professor of English. Ed.D., Duke University.
- Beute, Marvin Kenneth*, Professor of Plant Pathology. Ph.D., Michigan State University.
- Bevis, Michael Graeme*, Assistant Professor of Marine, Earth and Atmospheric Sciences. Ph.D., Cornell University.
- Bewley, Glenn Carl*, Professor of Genetics. Ph.D., University of North Carolina at Chapel Hill.
- Bhattacharyya, Bibhuti Bhushan*, Professor of Statistics. Ph.D., London School of Economics, England.
- Bilderback, Theodore Eugene*, Associate Professor of Horticultural Science. Ph.D., Kansas State University.
- Bingham, William Louis*, Associate Professor of Civil Engineering. Ph.D., Pennsylvania State University.
- Binkowski, Francis S.*, Adjunct Associate Professor of Marine, Earth and Atmospheric Sciences. Ph.D., New York University.

- Bireline, George Lee, Jr.*, Professor Emeritus of Architecture. M.A., University of North Carolina at Chapel Hill.
- Bishir, John William*, Professor of Mathematics. Ph.D., North Carolina State University.
- Bishop, Paul Edward*, Associate Professor (USDA) of Microbiology. Ph.D., Oregon State University.
- Black, Betty Lynne*, Associate Professor of Zoology. Ph.D., Washington University.
- Blair, Neal Edward*, Assistant Professor of Marine, Earth and Atmospheric Sciences. Ph.D., Stanford University.
- Blake, Carl Thomas*, Professor Emeritus of Crop Science. Ph.D., Pennsylvania State University.
- Bland, George F.*, Associate Professor of Electrical and Computer Engineering and Assistant Dean for Undergraduate Programs, School of Engineering. M.S., University of Illinois.
- Blank, Philip Everett, Jr.*, Professor of English. Ph.D., University of North Carolina at Chapel Hill.
- Blankenship, Sylvia M.*, Assistant Professor of Horticultural Science, Ph.D., Oregon State University.
- Blazich, Frank Arthur*, Associate Professor of Horticultural Science. Ph.D., Pennsylvania State University.
- Block, William Joseph*, Professor Emeritus of Political Science and Public Administration. Ph.D., University of Illinois.
- Bloomfield, Peter*, Professor of Statistics. Ph.D., University of London, England.
- Blue, Nelson Allen*, Visiting Assistant Professor of Computer Science. Ph.D., Washington State University.
- Blum, Udo*, Professor of Botany. Ph.D., University of Oklahoma.
- Blume, Denise E.*, Adjunct Assistant Professor of Botany. Ph.D., Miami University.
- Blumer, Thomas Nelson*, Professor Emeritus of Food Science. Ph.D., Michigan State University.
- Bogdan, John Francis*, Professor Emeritus of Textile Engineering and Science. B.T., Lowell Technological Institute.
- Bonham, Julia C.*, Assistant Professor of History and University Studies. Ph.D., Brown University.
- Boles, Michael A.*, Associate Professor of Mechanical and Aerospace Engineering. Ph.D., North Carolina State University.
- Bonaminio, Vincent Paul*, Associate Professor of Horticultural Science. Ph.D., North Carolina State University.
- Bonanno, A. Richard*, Assistant Professor of Horticultural Science. Ph.D., Oregon State University.
- Boone, Edgar John*, Professor of Adult and Community College Education and Head of the Department; Assistant Director of Agricultural Extension Service. Ph.D., University of Wisconsin.
- Boos, Dennis Dale*, Associate Professor of Statistics. Ph.D., Florida State University.
- Borden, Roy H.*, Associate Professor of Civil Engineering. Ph.D., Northwestern University.
- Boss, Charles Ben*, Associate Professor of Chemistry. Ph.D., Indiana University.
- Boss, Wendy Farmer*, Associate Professor of Botany. Ph.D., Indiana University.
- Bostian, Carey Hoyt*, Professor Emeritus of Genetics and Chancellor Emeritus. Ph.D., University of Pittsburgh.
- Bowden, Edmond Francis*, Assistant Professor of Chemistry. Ph.D., Virginia Commonwealth University.
- Bowen, Henry Dittimus*, Professor of Biological and Agricultural Engineering. Ph.D., Michigan State University.
- Bowen, Lawrence Hoffman*, Professor of Chemistry. Ph.D., Massachusetts Institute of Technology.
- Bowers, Crowell Gattis, Jr.*, Assistant Professor of Biological and Agricultural Engineering. Ph.D., North Carolina State University.
- Bowman, Daryl Thomas*, Assistant Professor of Crop Science. Ph.D., Louisiana State University.

- Bowman, Karl Frederick*, Assistant Professor of Food Animal and Equine Medicine. D.V.M., Michigan State University.
- Bradbury, Phyllis Clarke*, Professor of Zoology. Ph.D., University of California at Berkeley.
- Braddy, Barri Ann*, Visiting Assistant Professor of Psychology. Ph.D., North Carolina State University.
- Bradley, Julius Roscoe, Jr.*, Professor of Entomology. Ph.D., Louisiana Technological University.
- Bradow, Ronald L.*, Adjunct Professor of Mechanical and Aerospace Engineering. Ph.D., University of Mississippi.
- Brake, John Thomas*, Associate Professor of Poultry Science. Ph.D., North Carolina State University.
- Brandenburg, Rick L.*, Assistant Professor of Entomology. Ph.D., North Carolina State University.
- Breitschuerdt, Edward Bealmear*, Associate Professor of Companion Animal and Special Species Medicine. D.V.M., University of Georgia.
- Bridgwater, Jr., Floyd Emmitt*, Professor (USFS) of Forestry. Ph.D., Oklahoma State University.
- Briggs, Garrett*, Professor of Marine, Earth and Atmospheric Sciences and Dean of the School of Physical and Mathematical Sciences. Ph.D., University of Wisconsin.
- Bright, Richard*, Professor Emeritus of Chemical Engineering. M.S., Iowa State University.
- Brim, Charles Aloysius*, Professor Emeritus of Crop Science. Ph.D., University of Nebraska.
- Brisson, Robert Curtis*, Associate Professor of Sociology and Anthropology. Ph.D., North Carolina State University.
- Britt, Jack Haiden*, Professor of Animal Science and Coordinator of Physiology Program. Ph.D., North Carolina State University.
- Brooks, Robert Charles*, Professor Emeritus of Economics and Business. Ph.D., Duke University.
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The University of North Carolina is comprised of all the public institutions of higher education in North Carolina that confer degrees at the baccalaureate level or higher. The University was authorized by the State Constitution in 1776, and it was chartered in 1789 by the General Assembly.

The University of North Carolina opened its doors to students at Chapel Hill in 1795. Thereafter, beginning in the latter part of the nineteenth century, the General Assembly of North Carolina has established and supported fifteen other public senior institutions in keeping with Article IX, Section 8, of the Constitution of North Carolina which provides that the "General Assembly shall maintain a public system of higher education, comprising The University of North Carolina and such other institutions of higher education as the General Assembly may deem wise."

By 1969, The University of North Carolina included six constituent institutions, governed by a single Board of Trustees. This multi-campus University had its beginnings in legislation enacted in 1931 that defined The University of North Carolina to include The University of North Carolina at Chapel Hill, North Carolina State University at Raleigh, and The University of North Carolina at Greensboro. In the 1960's three additional campuses were added: The University of North Carolina at Charlotte, The University of North Carolina at Asheville, and The University of North Carolina at Wilmington.

Beginning in 1877, the General Assembly of North Carolina established or acquired ten additional separately governed state-supported senior institutions of higher education. They are: Appalachian State University, East Carolina University, Elizabeth City State University, Fayetteville State University, North Carolina Agricultural and Technical State University, North Carolina Central University, North Carolina School of the Arts, Pembroke State University, Western Carolina University, and Winston-Salem State University. Then, in 1971, the General Assembly redefined The University of North Carolina, and under the terms of that legislation all sixteen public senior institutions became constituent institutions of The University of North Carolina.

The constitutionally authorized Board of Trustees of the six-campus University of North Carolina was designated the Board of Governors and this body is by law The University of North Carolina. The Board of Governors consists of thirty-two members elected by the General Assembly, and it is charged with "the general determination, control, supervision, management, and governance of all affairs of the constituent institutions." The chief executive officer of The University is the President.

Each constituent institution of The University has its own faculty and student body. The chief administrative officer of each institution is the chancellor, and the chancellors are responsible to the President.

Each constituent institution also has a board of trustees composed of thirteen members: eight elected by the Board of Governors, four appointed by the Governor, and the elected president of the student body *ex officio*. (The School of the Arts has two additional *ex officio* trustees.) The principal powers of these institutional boards are exercised under a delegation of authority from the Board of Governors.

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NORTH CAROLINA STATE UNIVERSITY



Access Key

● can be entered by an individual in a wheelchair with no assistance.

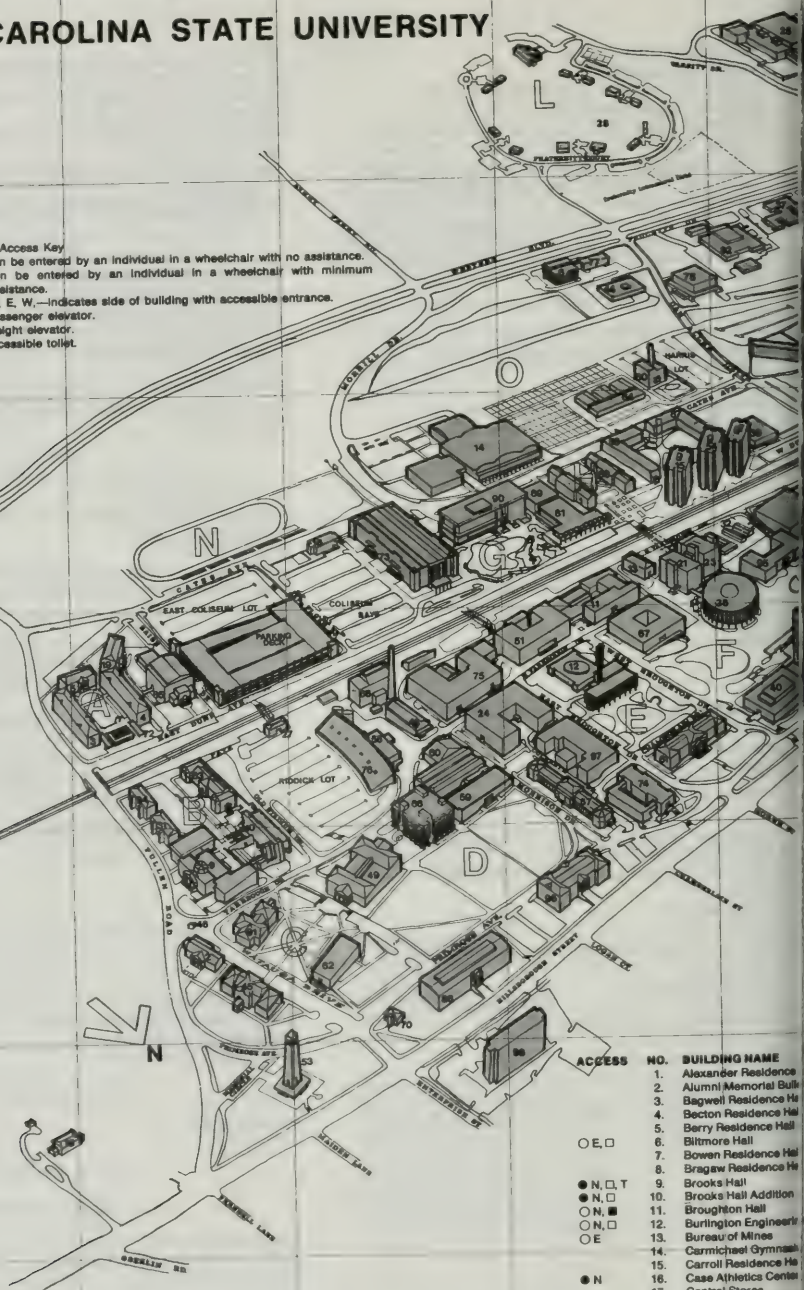
○ can be entered by an individual in a wheelchair with minimum assistance.

N, S, E, W.—indicates side of building with accessible entrance.

□ passenger elevator.

■ freight elevator.

T accessible toilet.



ACCESS

○ E, □

● N, □ T

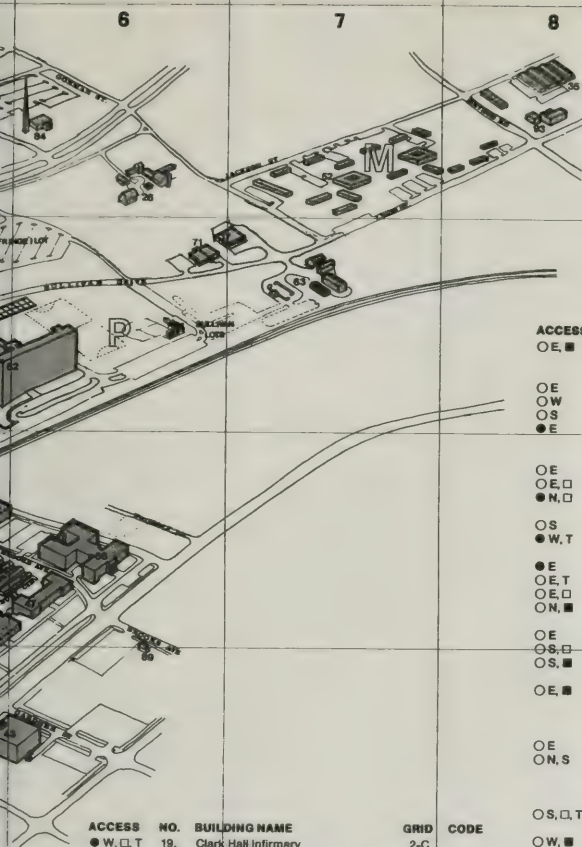
○ N, ■

○ N, □

○ E

● N

- | NO. | BUILDING NAME |
|-----|------------------------|
| 1. | Alexander Residence |
| 2. | Alumni Memorial Bldg. |
| 3. | Bagwell Residence Hs. |
| 4. | Becton Residence Hall |
| 5. | Berry Residence Hall |
| 6. | Blitmore Hall |
| 7. | Bowen Residence Hall |
| 8. | Bragaw Residence Hall |
| 9. | Brooks Hall |
| 10. | Brooks Hall Addition |
| 11. | Broughton Hall |
| 12. | Burlington Engineering |
| 13. | Bureau of Mines |
| 14. | Carmichael Gymnasium |
| 15. | Carroll Residence Hs. |
| 16. | Case Athletics Center |
| 17. | Central Stores |
| 18. | Chancellor's Residence |



ACCESS	NO.	BUILDING NAME	GRID	CODE
● W, □, T	19.	Clark Hall Infirmary	2-C	
○ S, ■	20.	Clark Laboratories	5-D	
○ N, □	21.	Cox Hall	4-D	COX
○ N, T	22.	Cultural Center	5-D	
○ N, □	23.	Dabney Hall	4-D	
● W, ■	24.	Darblets Hall	4-C	DAB DAN
● W, □, T	25.	McKinnon Extension Continuing Education Center	5-F	
	26.	Farm Unit 5	6-F	
○ N	27.	Field House	2-C	
○ S, ■	28.	Fraternity Court	4-F	
● N, □, T	29.	Gardner Hall	5-D	GA
	30.	Boylan Hall	5-D	
	31.	Gold Residence Hall	2-C	
	32.	Greenhouse—Agronomy	5-D	AGH
	33.	Greenhouse—Biological Sciences	5-D	BSG
	34.	Greenhouse—Horticulture	5-D	HGH
	35.	Greenhouse—840 Method Rd.	6-F	
	36.	Greenhouse—Plant Pathology	5-D	PPG
	37.	Grinnells Animal Health Lab	5-E	GHL
	38.	Harrison Hall	5-D	HA
	39.	Harris Hall	5-D	
	40.	D. H. Hill Library—Original Wing	5-C	DHL
	41.	D. H. Hill Library—Book Stack Tower	5-C	
	42.	D. H. Hill Library—Erdahl-Cloyd Wing	5-C	
● N, □, T	43.	Hillsborough Building	5-C	HLB
○ W	44.	Hodges Wood Products Lab	4-E	HWP
	45.	Holiday Hall	2-B	
	46.	Information Center, Visitor Parking	2-B	
○ S, ■	47.	Kilgore Hall	6-D	KI
	48.	Laundry	3-C	
	49.	Leazar Hall	3-B	LEZ
	50.	Lee Residence Hall	5-E	
● S, □	51.	Mann Hall	4-C	MN
	52.	E. S. King Village (17 Apt. Bldgs. A-Q)	7-F	
	53.	Mammoth Tower	3-A	
	54.	Metcalf Residence Hall	4-D	
● S	55.	Morris Building	3-C	

ACCESS	NO.	BUILDING NAME	GRID	CODE
○ E, ■	56.	Nelson Textile Building	6-D	N
	57.	1911 Building	4-C	
	58.	Owen Residence Hall	4-D	
○ E	59.	Pige Hall	3-C	PA
○ W	60.	Park Shops	3-C	PS
○ S	61.	Patterson Hall	4-C	PT
● E	62.	Peggie Hall	3-A	
	63.	Physical Plant Maint. Center	7-E	
	64.	Physical Plant Shops (Armory)	4-D	
○ E	65.	Phytotron	5-D	PHY
○ E, □	66.	Poe Hall	3-C	POE
● N, □	67.	Polk Hall	4-C	PK
	68.	Power Plant	5-E	
○ S	69.	Price Music Center	4-D	PMC
● W, T	70.	Primrose Hall	3-B	
	71.	Print Shop/University Graphics	6-E	
● E, T	72.	Quad. Snack Bar	2-C	
○ E, □	73.	Wm. Neal Reynolds Coliseum	3-D	
○ N, ■	74.	Riddick Hall	4-C	RI
	75.	Riddick Engineering Labs	3-C	RD
	76.	Riddick Stadium	3-C	
○ E	77.	Robertson Wing, Biltmore Hall	4-E	
○ S, □	78.	Schaub-Food Science Building	4-E	SFS
○ S, ■	79.	Scott Hall	5-D	SC
	80.	Steam Plant	4-E	
○ E, ■	81.	Students Supply Store	4-D	
	82.	Sullivan Residence Hall	6-E	
	83.	Syme Residence Hall	2-C	
	84.	Television Center	6-F	TVS
○ E	85.	Thompson Theater/Craft Center	2-C	TT
○ N, S	86.	Tompkins Hall	3-B	T
	87.	Tucker Residence Hall	4-D	
	88.	Turlington Residence Hall	4-D	
	89.	Turner House	6-C	
○ S, □, T	90.	University Student Center	2-D	USC
○ W, ■	91.	Watauga Hall	2-D	
	92.	Weaver Laboratories	5-E	DSW
	93.	Weed Control Laboratories	6-F	
	94.	Welch Residence Hall	2-C	
○ S, ■	95.	Williams Hall	5-D	WMS
○ N, S	96.	Winston Hall	4-B	WN
○ E, ■	97.	Withers Hall	4-C	WI
● E, □	98.	(John Yancey) N. Residence Hall	3-A	

FOURTH AND FIELDS	GRID
A. Bagwell-Becton-Berry Quad	2-C
B. Gold-Welch-Syme-Brooks Court	2-C
C. Holiday Hall Court	3-B
D. Court of North Carolina	3-B
E. Gardner Arboretum	4-C
F. University Plaza (Brickyard)	5-C
G. University Student Center Plaza	4-D
H. Turlington-Alexander Court	4-D
I. Tucker-Owen Court	4-D
K. Lee-Sullivan-Bragaw Court	5-E
L. Fraternity Court	4-F
M. E. S. King Village Court	7-F
N. Paul H. Derr Track	2-D
O. Miller Fields	4-E
P. Oak Field	6-E
Q. McKinnon Center Court	5-F

PARKING LOTS	GRID
Brooks Ave. Lot	6-C
Carmichael Lot	3-D
Coliseum Bays	3-D
East Coliseum Lot	2-C
Friendly Drive Lot	6-D
Harris Lot	4-E
Hillsborough Building Lots	6-C
Parking Deck	2-C
Riddick Lot	3-C
Sullivan Lots	6-E
West Lot	6-E
Yarbrough Lot	3-C

CODE

BI

BS

A

BU

CG

F

E

D

C

B

A

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